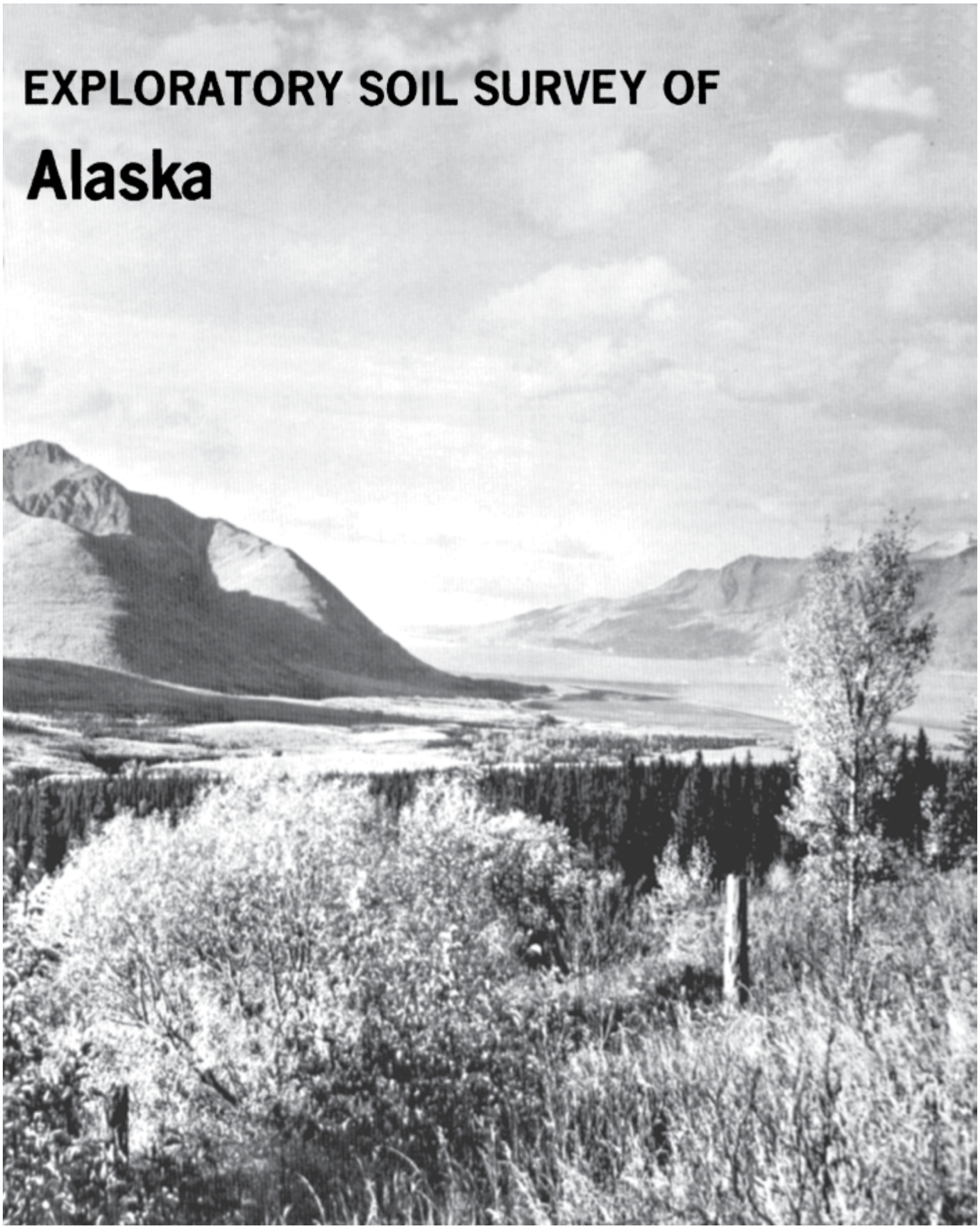
EXPLORATORY SOIL SURVEY OF

Alaska



United States Department of Agriculture, Soil Conservation Service

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Soil maps in this survey may be copied without permission, but any enlargement of these maps could cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Humic Cryorthods and Terric Cryohemists occupy the Resurrection Valley near Hope. Rough mountainous land is in the distance.

Contents

Contents—Continued

Issued February 1979

Index to Map Units

Index to Map Units—Continued

Summary of Tables

Foreword

The Exploratory Soil Survey of Alaska contains much information useful in large-scale land planning. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are inherent limitations or hazards of the soils for land uses and the impact that selected land uses will have on the environment.

This survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soils for food and fiber production. Planners, community officials, engineers, and developers can use it to plan land use, select areas suitable for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Alaska's scenic and wilderness values, its wildlife, and its great mineral potential are justly celebrated, but, as this survey shows, the State can also be productive in other ways. More than 20 million acres in Alaska is considered suitable for the production of grasses, small grains, potatoes, and a wide variety of vegetable crops. Natural grasslands on an additional 18 million acres can be grazed by cattle or sheep. More than half of the State supports vegetation that can be used by reindeer. Commercial forestry is possible on about 40 million acres.

Great differences in soil properties occur even within short distances. Soils may be organic, seasonally wet, or subject to flooding. They may be shallow over bedrock or permafrost. They may be too unstable for buildings or roads. Perennially frozen or wet soils are poorly suited to septic tank absorption fields. Organic soils or soils with a high water table are poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this survey. Each kind of soil in Alaska is described, and information is given about each soil for selected uses. Additional information and assistance in using this publication can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service.

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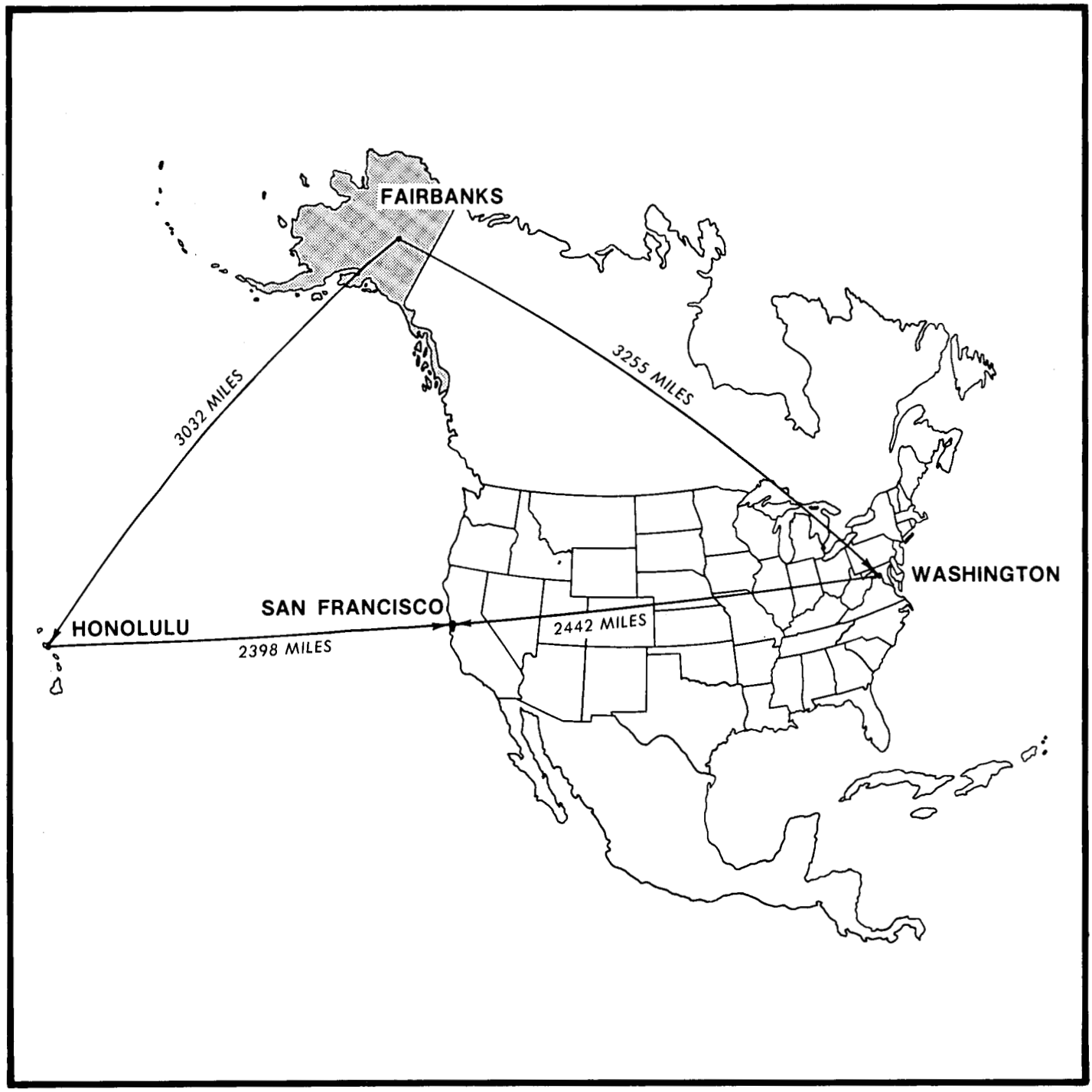
Acknowledgements

Most of the information on soils of National Forests in southeastern and south central Alaska in this survey is based on investigations by soil scientists of the Forest Service. Remote facilities of the U. S. Air Force and the Naval Arctic Research Laboratory were of great help to the field parties during the course of the survey.


FAIRBANKS
3032 MILES
3255 MILES
WASHINGTON
SAN FRANCISCO
HONOLULU
2442 MILES
2398 MILES

EXPLORATORY SOIL SURVEY OF ALASKA

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The earliest soil surveys in Alaska were made in 1914 (*4*)[1] as part of a study of possible routes for the Alaska Railroad and in 1916 (*3*) "for the purpose of studying the soils, agriculture, and other resources and the general economic conditions within and adjacent to the Chugach National Forest." Those surveys, though now largely of historical interest from the standpoint of soil classification, provide a good review of agricultural development in Alaska. No detailed soil surveys were made in Alaska until 1939 and 1940, when a Soil Conservation Service party mapped part of the Matanuska Valley (*56*). The first comprehensive investigation of the soils of Alaska was made in 1946 and resulted in publication in 1951 (*34*) of a schematic map and a general discussion of the soils.

With establishment of the Alaska State Office of the Soil Conservation Service in 1948, soil surveys in cooperation with the Alaska Agricultural Experiment Station became an important part of SCS operations. At the present time, surveys made according to modern standards have been completed for the principal farming and ranching areas in the Tanana Valley (*50, 58*), the Cook Inlet-Susitna Lowland (*30, 49, 57, 59*), and Kodiak Island (*54*), and in a number of smaller areas elsewhere in the State. Soil surveys also have been made of parts of the National Forests in south central and southeastern Alaska by the Forest Service. Surveys of additional areas by both the Soil Conservation Service and the Forest Service are in progress.

Despite these activities, however, it has long been apparent that only a general small-scale survey could provide the soil information needed for wise and efficient land use planning throughout the State within a reasonable time. This exploratory survey was initiated in 1967 to meet this need. It was completed in 1973.

Field mapping was done at a scale of 1:500,000 (about 8 miles to 1 inch or 5 km to 1 cm). All existing soil maps and reports were utilized, but the exploratory soil map was based largely on observations made from a small helicopter that landed frequently in roadless areas for onsite soil identification. Distinctive landscape patterns were identified from the air and delineated on the map. Soils within each landscape segment were described and classified; relationships between the soils, the native vegetation, and landforms were noted; and the proportion of the area occupied by each major kind of soil was estimated. In essence, each map unit in this survey is an association of soils arranged in a consistent pattern. Individual soil boundaries, however, are not shown.

Alaska, as might be expected in an area of its size and climatic diversity, has many different kinds of soils. Five of the 10 orders in the Soil Taxonomy (*80*) are represented in the State, and 74 subgroups were mapped in the course of this survey. Poorly drained soils with permafrost—Pergelic Cryaquepts and Histic Pergelic Cryaquepts—are the most extensive and occupy about one-third of interior, western, and arctic Alaska. Organic soils, many of which are also perennially frozen, cover a greater acreage in Alaska than in all other States combined. Almost 80 million acres is Rough mountainous land. This includes about 16.5 million acres under a permanent ice cover. Well drained soils at lower elevations include forested Cryorthods in southeastern and south central Alaska, forested Cryochrepts in the interior, and grass-covered Cryandepts in the southwest.

It is important to recognize that this exploratory survey does not provide all of the information that is available in detailed soil surveys. For intensive use of a particular area, the information in this survey should be supplemented with additional observations and descriptions of soils and soil distribution patterns. This survey is useful, however, for general land use planning and as a guide to the most desirable areas for any specific purpose. Each map unit and its major components are evaluated, according to soil or topographic limitations, for farming or gardening, grazing, commercial forestry, recreation, construction of buildings and highways, and off-road movement. Although these interpretations are generally valid, some soils within any mapped area may have properties and limitations that differ from those described for the unit as a whole.

Major land resource areas

Fifteen major land resource areas have been recognized in Alaska. Each is characterized by a unique pattern of topography, climate, vegetation, and soils. The areas are described briefly on the pages that follow. Their estimated acreages are listed in table 1. Table 2 gives temperature and precipitation data from selected places in each area.

Southeastern Alaska

This area includes mountains and foothills of the mainland east of the St. Elias Mountains and the

[1] Italic numbers in parentheses refer to entries in Bibliography, p. 208.

TABLE 1.—*Estimated acreage of major land resource areas*

Major land resource area	Estimated acreage		
	Land	Water	Total
Total	362,516,000	12,788,000	375,304,000
Southern Alaska:			
Southeastern Alaska	18,743,000	8,000	18,751,000
South Central Alaska Mountains	30,043,000	134,000	30,177,000
Cook Inlet-Susitna Lowland	7,333,000	222,000	7,555,000
Alaska Peninsula and Southwestern Islands	22,653,000	816,000	23,469,000
Interior Alaska:			
Copper River Plateau	8,999,000	369,000	9,368,000
Alaska Range	18,962,000	12,000	18,974,000
Interior Alaska Lowlands	30,559,000	2,268,000	32,827,000
Koyukuk-Innoko Lowland	8,760,000	887,000	9,647,000
Kanuti Flats	1,129,000	44,000	1,173,000
Tanana-Kuskokwim Lowland	12,238,000	804,000	13,042,000
Yukon Flats	8,432,000	533,000	8,965,000
Kuskokwim Highlands	46,826,000	911,000	47,737,000
Interior Alaska Highlands	53,435,000	318,000	53,753,000
Arctic and Western Alaska:			
Norton Sound Highlands	30,930,000	413,000	31,343,000
Western Alaska Coastal Plains and Deltas	18,434,000	4,263,000	22,697,000
Selawik-Kobuk Delta	1,787,000	401,000	2,188,000
Yukon-Kuskokwim Delta	10,300,000	2,926,000	13,226,000
Bristol Bay Coastal Plain	6,347,000	936,000	7,283,000
Bering Sea Islands	2,629,000	217,000	2,846,000
Brooks Range	29,159,000	192,000	29,351,000
Arctic Foothills	31,488,000	135,000	31,623,000
Arctic Coastal Plain	12,323,000	2,510,000	14,833,000

islands of the Alexander Archipelago. It is dominated by rugged hills and mountains that rise abruptly from the sea. Long narrow bays, carved by glaciers, create extremely irregular coastlines on both the mainland and the islands. Strips of hilly moraines border most of the bays and short flat-bottomed valleys at their heads. Glaciers flow out of icefields that cover high mountains on the mainland, some of them reaching tidewater. Only a few glaciers remain on the islands, however, confined to the highest peaks.

Coastal forests of western hemlock, Sitka spruce, and Alaska redcedar extend to elevations of about 1,500 feet (450 m). Sedges, mosses, and shrubs cover much of the area directly above tree line and occupy many drainageways and hillsides in the forested zone.

The area has a cool maritime climate, characterized by heavy precipitation throughout the year. At the lower elevations winters are mild for the latitude and summers are cool (see data for Juneau, Ketchikan, and Sitka in table 2). Frost-free seasons are long, but are offset by low summer temperatures and persistent cloud cover. Strong winds are common, especially in winter.

Fishing and logging are the principal industries. The population is almost entirely in coastal cities and villages. Most soils are too steep, too stony, or too wet for farming, and there are no large commercial farms.

South Central Alaska Mountains

This area includes the St. Elias, Chugach (fig. 1), and Kenai Mountains bordering the Gulf of Alaska and the Wrangell and Talkeetna Mountains farther inland. Large icefields cap most of these mountains, and many glaciers (figs. 2 and 3) flow down their sides. Moraines, outwash plains, and other glacial features are everywhere visible on lower slopes and in areas adjacent to the mountains. Several large coastal lowlands, consisting of glacial outwash and tidal deposits, lie between the mountains and the sea. High dunes are common along the coast and in areas bordering large rivers flowing from the mountains.

Forests dominated by western hemlock and Sitka spruce border most of the Gulf of Alaska coast. The tree line is at 1,000 to 1,500 feet (300–450 m). Sedges and mosses occupy most areas directly above tree line in the coastal mountains and some wet areas in the forested zone. In a few places, especially in the Kenai and Talkeetna Mountains bordering the Cook Inlet-Susitna Lowland, the vegetation above tree line is principally grasses, forbs, willows, and alder. Low-growing alpine vegetation occupies higher areas. On the interior faces of the mountains bordering the Copper River Plateau, forests of black spruce, dwarf birch, and willow range up to elevations of about 3,000 feet (900 m), where low-growing alpine vegetation becomes dominant. The broad coastal lowlands are mostly marshy. Forests of hemlock and spruce occupy slightly higher terraces, stabilized dunes, and beach ridges.

The resource area has a variety of climates. Slopes bordering the Gulf of Alaska and, to a lesser extent, the Cook Inlet-Susitna Lowland have the high precipi-

Figure 1.—**Large glacier at head of Matanuska River in Chugach Mountains.**

tation and moderate temperatures characteristic of coastal regions (see data for Cordova and Yakutat in table 2). Slopes bordering the Copper River Plateau have the low precipitation and marked seasonal temperature differences of interior Alaska. At higher elevations the precipitation is mostly snow, and summer temperatures are so low that ice persists throughout the year.

In the past, coal mining in the Talkeetna Mountains and copper mining in the Wrangell and Chugach Mountains were important industrial activities. Oil may be present in commercial quantities in some of the coastal lowlands. Some logging has been done in areas bordering the Gulf. Farming is not of commercial importance. The population is low and is concentrated in small cities and villages on the coast. Commercial fishing is a major occupation.

Cook Inlet-Susitna Lowland

This area is a long narrow basin between the Kenai, Chugach, and Talkeetna Mountains to the east and the Aleutian and Alaskan Ranges to the west. Most of the northern half of the Lowland is drained by the Susitna River and its tributaries. The southern half borders Cook Inlet, which opens into the Gulf of Alaska. The Matanuska Valley is an eastern extension of the Lowland from the head of Cook Inlet.

The entire basin is underlain by sediments of the Tertiary age, but the surface consists principally of glacial deposits, including low moraines interspersed with many lakes, bogs, and broad outwash plains. Level terraces up to several miles wide border the principal rivers, most of which flow from glaciers in the surrounding mountains. Only in the southwestern

TABLE 2.—*Temperature and*

[U.S. Weather Service data from the Arctic Information and Data Center, University of Alaska, Anchorage. Data from stations climatic features of the major land resource areas. Because they do not always cover

Station	Mean temperature										
	Years of record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct
		°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
Southeastern Alaska:											
Juneau (City)	30	28.5	29.9	34.3	41.0	48.3	54.8	56.9	56.2	51.3	43.9
Juneau (Airport)	30	23.5	28.0	31.9	38.9	46.8	53.2	55.7	54.3	49.2	41.8
Ketchikan	30	35.1	36.2	38.7	43.6	50.1	55.2	58.2	58.9	54.6	47.6
Sitka	30	32.3	33.3	35.8	40.8	46.4	51.4	54.8	55.5	51.9	45.2
South Central Alaska Mountains:											
Cordova (Airport)	30	23.1	26.2	29.1	36.2	43.7	50.2	53.2	52.4	47.6	39.8
Yakutat	30	24.2	28.0	30.3	36.1	43.3	49.7	53.4	52.9	48.4	40.7
Cook Inlet-Susitna Lowland:											
Anchorage	30	11.8	17.8	23.7	35.3	46.2	54.6	57.9	55.9	48.1	34.8
Homer	30	21.4	24.9	27.6	35.0	42.3	48.7	52.3	52.4	47.0	37.4
Kenai	22	12.7	16.5	21.3	32.7	42.9	49.5	53.5	53.1	46.8	35.0
Palmer	25	13.9	19.4	24.7	36.6	47.1	54.7	57.3	55.1	47.9	34.9
Talkeetna	30	9.4	15.3	20.0	32.6	44.7	55.0	57.9	54.6	46.1	32.1
Alaska Peninsula and Southwestern Islands:											
Adak	20	33.9	33.4	35.3	37.8	41.3	45.1	49.6	51.7	48.3	42.6
Cold Bay	30	28.2	28.2	29.0	33.1	39.5	45.4	50.1	51.3	47.3	39.6
Kodiak	30	30.4	31.4	32.1	36.9	43.2	49.7	54.1	54.9	50.0	40.7
Copper River Plateau:											
Eureka	11	−0.6	4.9	8.2	22.1	36.5	48.1	51.8	49.5	40.5	22.3
Glennallen	5	−15.3	5.0	16.4	30.1	42.3	53.6	55.8	50.7	40.2	23.7
Kenny Lake	5	−6.2	5.8	14.7	31.7	40.7	51.4	55.7	52.0	44.2	31.7
McCarthy	5	−16.7	7.4	19.0	32.1	44.1	53.1	56.1	52.2	44.8	28.9
Alaska Range:											
McKinley Park	30	1.4	7.1	13.2	27.5	41.5	52.2	54.6	50.4	41.3	25.9
Paxson Lake	5	−16.9	−6.1	9.3	23.0	38.4	48.5	52.4	48.3	39.4	24.2
Interior Alaska Lowlands:											
Bettles	30	−13.2	−7.8	1.5	20.5	41.7	56.2	57.9	51.9	40.0	20.0
Fairbanks	30	−11.9	−2.5	9.5	28.9	47.3	59.0	60.7	55.4	44.4	25.2
Fort Yukon	30	−19.8	−15.1	0.9	21.5	43.6	58.8	61.3	55.1	41.2	20.8
Galena	20	−11.4	−5.9	4.4	22.8	42.8	58.8	59.8	53.9	43.5	24.5
McGrath	30	−8.9	−0.2	8.9	26.5	44.1	55.7	58.2	53.5	43.8	25.3
Kuskokwim Highlands:											
Dillingham	32	15.7	18.6	20.3	30.9	41.9	51.8	55.1	54.0	47.5	34.7
Minchumina	23	−6.4	−1.6	9.3	26.4	44.4	56.6	59.5	54.3	43.6	24.4
Ruby	9	−5.8	−0.5	6.0	25.4	42.9	57.2	57.6	4.8	42.7	25.9
Interior Alaska Highlands:											
Boundary	8	−11.9	−6.3	10.1	23.9	40.4	51.6	54.7	51.4	40.1	20.8
Hughes	25	−8.6	−4.9	3.9	22.4	41.3	55.2	57.9	54.3	42.5	22.8
Livengood	12	−11.9	−6.0	6.1	25.8	44.8	57.0	58.6	53.2	42.2	23.3
Norton Sound Highlands:											
Candle	5	−11.2	−7.1	−1.8	10.2	31.8	46.6	52.9	50.0	40.3	24.2
Holy Cross	30	0.5	6.5	12.4	29.0	43.2	55.3	57.6	54.2	45.1	30.3
Nome	30	6.0	5.2	7.4	18.9	34.8	45.5	50.1	49.2	42.1	28.5
Unalakleet	30	3.4	4.6	9.4	22.1	37.8	48.5	54.0	51.9	43.5	27.3
Western Alaska Coastal Plains and Deltas:											
Bethel	30	5.1	8.2	11.4	24.5	40.1	51.6	54.7	52.3	45.0	30.2
Kotzebue	30	−3.7	−4.3	−0.5	13.0	30.8	43.5	52.9	50.7	41.1	23.6
King Salmon	30	13.4	16.6	20.4	31.5	42.6	50.7	54.5	53.8	47.3	33.6

precipitation at selected stations

with long records are for 30-year periods ending in either 1960 or 1970. These and shorter-term data are intended to illustrate gross the same time period they should not be used for direct comparisons between stations]

Mean temperature—Continued			Mean precipitation											
Nov	Dec	Annual	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
°F	°F	°F	In	In	In	In	In	In	In	In	In	In	In	In	In
36.3	30.6	42.7	7.23	5.86	6.02	5.91	5.53	4.48	6.10	7.61	10.34	13.40	10.48	8.02	90.98
32.5	27.3	40.3	3.94	3.44	3.57	2.99	3.31	2.93	4.69	5.00	6.90	7.85	5.53	4.52	54.67
40.9	36.7	46.3	13.90	11.24	12.29	12.12	8.63	7.23	8.13	10.65	14.08	22.26	17.84	15.64	154.01
38.6	33.6	43.3	7.77	6.38	6.95	5.35	4.66	3.46	5.20	7.86	11.49	15.27	12.01	10.17	96.57
31.1	25.6	38.2	6.10	4.64	3.84	4.32	5.06	3.48	6.27	8.06	12.51	11.90	8.02	6.78	80.98
32.2	26.7	38.8	10.36	9.28	9.57	7.65	8.02	5.68	8.46	10.81	15.45	19.52	14.80	12.86	132.46
21.1	13.0	35.0	0.84	0.84	0.56	0.56	0.59	1.07	2.07	2.32	2.37	1.43	1.02	1.07	14.74
28.2	21.4	36.5	1.70	1.54	1.22	1.09	0.91	1.06	1.70	2.56	2.85	3.38	2.76	2.29	23.06
21.3	12.1	33.1	1.12	1.10	1.14	0.95	0.83	1.34	2.23	2.79	3.62	2.24	1.27	1.28	19.91
21.2	13.2	35.5	1.01	0.65	0.58	0.54	0.69	1.61	2.36	3.20	2.65	1.37	0.94	0.90	16.50
17.5	9.0	32.8	1.63	1.79	1.54	1.12	1.46	2.17	3.48	4.89	4.52	2.54	1.79	1.71	28.64
37.3	34.5	40.9	6.64	5.48	6.74	4.81	4.83	3.57	3.28	3.94	5.71	7.08	7.99	8.01	68.08
34.3	29.0	37.9	2.42	2.59	1.93	1.54	2.19	1.84	2.22	3.89	3.95	4.31	3.90	2.45	33.23
34.8	29.9	40.7	5.01	4.89	3.85	3.81	4.35	4.12	3.54	4.30	6.11	6.29	5.41	5.03	56.71
7.1	0.1	24.2	0.76	0.85	0.67	0.49	1.23	3.17	2.62	2.18	1.38	0.85	0.83	0.98	16.01
6.7	−8.4	25.0	0.29	0.77	0.23	0.11	0.60	1.44	1.51	1.17	1.02	0.57	0.57	0.63	8.91
3.4	−6.0	26.6	0.98	1.14	0.57	0.34	0.31	1.45	1.66	1.33	1.43	0.64	0.86	1.15	11.86
8.1	−4.7	32.4	0.67	0.43	0.61	0.15	0.62	1.40	2.28	2.49	2.30	2.46	1.12	0.87	15.79
10.4	2.1	27.3	0.83	0.69	0.37	0.47	0.68	1.93	2.59	2.81	1.54	0.98	0.75	0.65	14.29
5.2	−4.3	21.8	0.58	0.52	0.62	0.38	0.84	2.39	3.11	2.54	2.14	2.24	0.60	0.95	16.91
−1.4	−12.2	21.3	0.72	0.77	0.82	0.63	0.62	1.22	1.79	2.77	1.78	1.23	0.81	0.82	14.18
2.8	−10.4	25.7	0.60	0.53	0.48	0.33	0.65	1.42	1.90	2.19	1.08	0.73	0.66	0.65	11.22
−4.2	−19.3	20.4	0.46	0.35	0.32	0.18	0.32	0.64	0.89	1.14	0.78	0.58	0.48	0.38	6.52
3.8	−12.4	23.7	0.69	0.93	0.90	0.52	0.79	1.25	2.32	2.81	1.59	0.75	0.71	0.76	14.02
5.0	−9.2	25.2	0.85	0.90	0.86	0.66	0.80	1.70	2.28	3.28	2.14	1.22	1.03	1.02	16.74
24.0	14.6	34.1	1.87	1.52	1.62	1.16	1.78	1.69	2.57	3.99	3.46	2.54	1.78	1.78	25.76
4.5	−7.2	25.7	0.66	0.52	0.50	0.43	0.77	1.74	2.40	3.07	1.35	0.73	0.59	0.59	13.35
5.7	−5.8	25.6	1.42	1.01	0.76	0.37	0.85	0.85	3.09	3.06	1.92	1.13	0.92	0.88	16.26
2.8	−9.5	22.3	0.44	0.37	0.34	0.17	1.29	2.33	2.63	2.66	0.95	0.78	0.49	0.77	13.22
1.2	−10.6	23.1	0.64	0.83	0.98	0.20	0.45	1.02	1.97	2.50	1.43	1.17	0.69	0.86	12.74
1.6	−9.4	23.8	0.40	0.39	0.54	0.29	0.93	1.75	2.31	2.94	1.36	0.86	0.72	0.61	13.10
5.0	−6.3	19.9	0.55	0.44	1.00	0.17	0.44	0.73	1.20	1.46	1.23	0.62	0.36	0.37	8.57
13.9	1.9	28.2	1.10	1.19	1.03	0.48	0.82	1.16	2.06	3.90	2.78	1.49	1.07	0.92	18.00
15.6	4.4	25.6	0.90	0.84	0.79	0.73	0.70	0.95	2.42	3.57	2.40	1.42	0.98	0.74	16.44
13.3	1.6	26.4	0.50	0.53	0.60	0.49	0.71	0.92	2.32	3.89	2.20	1.03	0.56	0.41	14.16
17.2	4.4	28.7	0.54	0.74	0.79	0.43	0.83	1.24	1.98	3.97	2.42	1.32	0.96	0.62	15.84
7.7	−3.9	20.9	0.29	0.30	0.33	0.33	0.40	0.52	1.55	2.26	1.43	0.61	0.41	0.33	8.76
22.1	11.7	33.2	0.94	0.99	1.16	0.90	1.13	1.44	2.18	3.46	3.07	2.00	1.43	1.05	19.75

TABLE 2.—*Temperature and*

Station	Mean temperature										
	Years of record	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct
		°F	°F	°F	°F	°F	°F	°F	°F	°F	°F
Bering Sea Islands:											
Gambell	10	5.2	3.0	4.7	16.9	28.8	37.3	44.2	44.5	39.5	31.9
Mekoryuk	27	11.6	10.6	14.2	23.1	33.7	42.7	48.4	49.6	45.3	34.6
St. Paul	30	26.1	23.0	23.8	28.5	34.9	40.9	45.7	47.5	44.4	37.8
Brooks Range:											
Anaktuvuk Pass	6	−14.9	−14.2	−7.1	4.0	30.0	47.1	50.8	45.2	31.9	8.5
Arctic Foothills:											
Umiat	5	−21.2	−27.1	−17.3	−0.9	20.1	42.1	53.5	48.4	32.3	13.5
Arctic Coastal Plain:											
Barrow	30	−14.7	−18.6	−15.2	−0.9	19.1	33.0	38.7	37.6	30.3	15.3
Barter Island	30	−15.2	−19.5	−14.7	0.1	21.1	34.1	40.0	38.9	31.6	16.4
Wainwright	25	−14.9	−19.8	−14.5	0.9	20.7	35.3	42.6	41.5	32.0	17.7

part of the Kenai Peninsula are the underlying sediments exposed. A mantle of loess, or loess and volcanic ash, covers the resource area.

The principal vegetation of the uplands is forest dominated by white spruce, paper birch, and, in drier areas, quaking aspen. Near the mouth of Cook Inlet, however, the principal tree is Sitka spruce. Cottonwood occurs commonly in areas bordering the principal streams and Cook Inlet. Black spruce is the dominant tree in wetter areas and on some well drained sites that have received repeated severe burns. Most muskegs (bogs) are treeless or support stands of stunted black spruce. Grasses, willow, and alder dominate the vegetation at elevations above 800 feet (240 m) near

Figure 2.—**Worthington Glacier in Chugach Mountains along Richardson Highway.**

precipitation at selected stations—Continued

Mean temperature—Continued			Mean precipitation											
Nov	Dec	Annual	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
°F	°F	°F	In	In	In	In	In	In	In	In	In	In	In	In	In
23.4	10.9	24.2	0.97	1.22	1.19	1.21	0.69	0.60	1.81	2.60	1.45	1.41	1.28	1.40	15.83
25.0	13.4	29.4	0.89	1.01	1.16	0.81	0.61	0.76	1.38	2.29	2.13	1.95	1.26	1.06	15.31
33.2	27.8	34.5	1.84	1.37	1.26	1.09	1.28	1.25	2.23	3.44	3.02	3.15	2.58	2.03	24.54
−6.0	−15.6	13.4	0.52	0.51	0.62	0.72	0.50	1.38	1.40	1.65	1.15	0.93	0.61	0.66	10.65
0.8	−20.8	10.3	0.31	0.20	0.18	0.41	0.11	0.53	0.84	1.20	0.57	0.41	0.53	0.42	5.71
−0.5	−12.3	9.3	0.23	0.20	0.19	0.21	0.17	0.35	0.88	1.04	0.58	0.55	0.30	0.19	4.89
0.2	−12.4	10.1	0.55	0.33	0.26	0.23	0.31	0.53	1.12	1.28	0.89	0.81	0.45	0.29	7.05
1.3	−12.2	10.9	0.13	0.09	0.15	0.28	0.19	0.22	1.37	1.94	0.48	0.74	0.18	0.08	5.85

the mouth of Cook Inlet and above 1,000 to 1,500 feet (300–450 m) farther north. The grasses and shrubs give way at higher elevations to low-growing alpine vegetation.

The climate of the Lowland has both maritime and continental characteristics (see data for Homer, Kenai, Anchorage, Palmer, and Talkeetna in table 2). At its southern end maritime influences are dominant, but the climate becomes increasingly continental to the north, where the seasonal temperature ranges are more pronounced. The Alaska Range, however, protects the resource area from the extreme temperatures of interior Alaska. Precipitation is moderate in the southern part and is fairly low in the central part. It in-

Figure 3.—Worthington Glacier in Chugach Mountains.

creases markedly in areas close to the east slopes of the Alaska and Aleutian Ranges. The highest amount of precipitation falls late in summer and in autumn. Strong winds are common in many places, especially near the mouths of mountain valleys.

This is the most densely populated resource area in Alaska. Anchorage, by far the largest city in Alaska, is the commercial and transportation center of the State. Oil production and related industries are important on the Kenai peninsula and the west side of Cook Inlet. The largest farming area in the State is in the Matanuska Valley. Nevertheless, large portions of the Cook Inlet-Susitna Lowland are very sparsely populated and are essentially wilderness.

Alaska Peninsula and Southwestern Islands

This area includes the Aleutian Range, the Alaska Peninsula, the Kodiak Island group, other small islands south and east of the Peninsula, and the Aleutian Islands. Total length of the area is more than 1,600 miles (2,500 km).

The mountains of the Aleutian Range and the Aleutian Islands are mostly of volcanic origin; many volcanoes are still active. Mountains in the Kodiak Island group, however, are a continuation of the nonvolcanic coastal mountains that border the Gulf of Alaska. Foothills throughout the area consist largely of glacial drift. Volcanic ash of varying thickness covers most of the lower elevations and cinder flows occur on the slopes of many volcanic cones.

Several vegetative types are in the area. In the northern part of the Kodiak Island group and in the northeastern part of the Alaska Peninsula, forests of Sitka spruce occur in coastal areas up to elevations of about 400 feet (120 m). Above the coastal forest and in large areas of foothills and moraines elsewhere on Kodiak Island and the Alaska Peninsula, the vegetation is dense grasses, alder, and other shrubs and forbs. At the tip of the Peninsula and on the Aleutian Islands, grasses and forbs dominate on hills at lower elevations, but low shrubs and other alpine plants occupy high ridges and low, level areas exposed to strong winds. Shrubby vegetation occupies much of the lowland in the northwestern part of the Alaska Peninsula between the Aleutian Range and Bristol Bay. Coastal tundra, dominated by sedges, borders much of Bristol Bay. Mountains throughout the area exhibit only glaciers and bare rock.

The climate is generally maritime, but it is influenced by the mountainous terrain (see data for Kodiak, Cold Bay, and Adak in table 2). The large temperature difference between the Bering Sea and the relatively warm Pacific Ocean results in much wind and fog, especially on the Aleutian Islands. Except in the high mountains, mean annual temperatures are above freezing. Summers are cool, and winters are relatively mild. Precipitation is heavy except in the northwestern part of the area. In winter, there is both rain and snow.

The principal industry is commercial fishing. There is also some logging on Afognak Island in the Kodiak Island group and some mining on the Alaska Peninsula and the Shumagin Islands. The extensive grasslands are used for beef cattle, primarily on Kodiak and adjacent islands, and wool-producing sheep, especially on Umnak and Unalaska Islands in the Aleutians. Cattle are wild on Chirikof and other islands. Caribou and wild reindeer herds range on parts of the Alaska Peninsula and Umnak Island.

Copper River Plateau

This area is a broad basin of rolling to hilly moraines and glacial lacustrine sediment, interspersed with many lakes. It is surrounded by mountains. The Chugach Mountains are to the south, the Wrangell Mountains to the east, the Alaska Range to the north, and the Talkeetna Mountains to the west. An arm of the basin extends southeastward up the Chitina Valley between the Wrangell and Chugach Mountains. The Plateau is drained by three major rivers—Copper, Matanuska, and Susitna—which flow to Cook Inlet and the Gulf of Alaska. In addition, the Nenana River, which flows north through the Alaska Range to the Yukon River system drains the northwest corner. All of the rivers originate in glaciers in the surrounding mountains.

Except for terraces and low hills bordering the Copper River and its major tributaries, the area is more than 2,000 feet (600 m) above sea level. At elevations between 2,000 and 3,000 feet (600 and 900 m) it is covered with a forest of black spruce and willow. Above 3,000 feet (900 m), low alpine shrubs, grasses, and sedges are dominant. Along the Copper and Chitina Rivers are second-growth forests of white spruce, paper birch, and quaking aspen. Similar forests occur in a few places at higher elevations on steep south-facing slopes.

The climate is strongly continental. Winters are long and cold. Summers are short and warm (see data for Eureka, Glennallen, Kenny Lake, and McCarthy in table 2). Mean annual temperatures are below freezing and precipitation is light to moderate. Growing seasons are short, and summer frosts are common. At lower elevations along the Copper and Chitina Rivers, however, it is possible to produce grasses, grains, and hardy vegetables.

A few farms are in the Kenny Lake area. Several large copper mines formerly operated in the Chitina Valley but are now abandoned. The population, which is sparse, is employed mostly in maintaining highways that traverse the area and in other government and tourist services. The area is used principally for hunting, especially caribou from a large herd that ranges the area, and for other recreation.

Alaska Range

This long, relatively narrow mountain chain arcs around south central Alaska and separates it from the hills and lowlands of the interior. It is very rugged and has many peaks higher than 10,000 feet (3,000 m), but several low passes permit relatively easy travel through it. The highest parts are perennially ice covered, and valley glaciers descend to elevations as low as 1,000 feet (300 m). Almost all of the landforms are of glacial origin. The transition to adjoining lowland areas is generally sharp.

Many principal rivers in south central Alaska

originate in the Alaska Range. Also, many streams flow north and west to the Tanana and Kuskokwim Rivers. These streams are major sources of the heavy silt loads in those rivers.

Most of the high steep slopes are bare. Shrubby alpine vegetation covers most lower slopes and passes. Black spruce forests occupy some low slopes, and natural grasslands occur in a few places.

Few temperature or precipitation measurements are available (see data for Paxson Lake and McKinley Park in table 2). Mean annual temperatures are well below freezing even in the low passes. Precipitation is fairly heavy on the southern and southeastern slopes, but is much lighter on the northern and western slopes. Strong winds are common throughout the area.

The permanent population is sparse and is principally employed serving highway traffic through the passes. There are few permanent hunting camps. A few horses kept by guides graze the grasslands. The population increases somewhat in summer, especially in the Mt. McKinley National Park area, and is engaged primarily in tourist services.

Interior Alaska Lowlands

This area includes broad valleys and plains between the Alaska Range on the south and east, the Brooks Range on the north, and the Norton Sound Highlands on the west. The area is divided into four parts. The Yukon Flats and the Kanuti Flats are large basins surrounded by hills. The Koyukuk-Innoko Lowland and the Tanana-Kuskokwim Lowland are long, relatively narrow plains bordering sections of major rivers in interior Alaska. Most of these lowlands are nearly level and are interlaced with streams, sloughs, shallow lakes, and marshes. Also included, however, are natural levees, glacial outwash plains, piedmont slopes, and some low rolling hills. A large part of the Yukon Flats consists of broad outwash fans at higher elevations than the present flood plains.

Vegetation in the low, wet areas is principally mosses, shrubs, and black spruce. All such areas are shallow over permafrost. The somewhat higher natural levees, outwash fans, outwash plains, and hills, however, support forests of white spruce, paper birch, quaking aspen, and cottonwood. These areas are either deep over permafrost or have no permafrost. Some higher slopes adjacent to the mountains support alpine tundra vegetation.

The climate is continental, characterized by long cold winters and short warm summers. Annual precipitation is moderate to low (see data for Bettles, Fairbanks, Fort Yukon, McGrath, and Galena in table 2). Thunderstorms are common in summer. Winds are a serious problem at the mouths of valleys in the bordering mountains.

Spring flooding occurs commonly along nearly all major rivers. Floods also can occur following periods of exceptionally heavy rainfall in midsummer.

Most populated places in interior Alaska are in this area or on low hills adjacent to it. The major population center is Fairbanks, but many other small settlements are on major rivers throughout the area. Most commercial activity is concentrated in Fairbanks, the supply center for the region. The principal occupations, other than subsistence fishing and hunting, are in transportation, services connected with military installations, and tourism.

Much of the actual and potential farmland of interior Alaska is on the well drained natural levees, terraces, outwash fans, and outwash plains in this area. Commercial farming is now largely confined to the Tanana Valley in the vicinity of Fairbanks and Delta Junction.

Kuskokwim Highlands

This area includes hills and low mountains between the central Yukon River and Bristol Bay. The northern part consists mostly of a series of rounded ridges 1,500 to 2,000 feet (450 to 600 m) in elevation separated by deep narrow valleys. A few peaks and ridges stand above the general level of the hills. The southern part includes rugged mountains, long narrow lakes partly in mountains and partly in the adjoining hills, and an extensive hilly area west of the Alaska Range. Glaciers formerly covered all of the area south of the headwaters of the Aniak and Holitna Rivers, but to the north only the higher peaks have glacial features.

The dominant vegetation is a forest of black spruce and willow, but low sedge and shrub tundra covers many hills and ridgetops. Hills bordering most of the Tikchik Lakes and Togiak Bay are covered with a dense stand of grasses and alder. Forests of white spruce and birch occur on low hills bordering the Yukon and Kuskokwim Rivers and Bristol Bay. These trees, together with cottonwood, also occupy natural levees in the flood plains of major rivers. Permafrost is nearly always under the black spruce and tundra but does not underlie the other vegetative types.

The climate is strongly continental in most of the area but is modified by maritime influences near the Bering Sea (see data for Ruby, Minchumina, and Dillingham in table 2). The mean annual temperature everywhere except the coast of Bristol Bay is below freezing. Precipitation is light in the north but increases southward toward the coast, where it is moderate.

The population is sparse and is concentrated in small villages on the coast and the major rivers. The largest settlement is Dillingham, which depends primarily on Bristol Bay fishing. A number of former mining towns in the Kuskokwim Hills are now deserted, or occupied only during the summer. Little use is made of the forests, and there is almost no farming.

Interior Alaska Highlands

This area includes hills between the Tanana and Yukon Rivers and the Brooks Range, and east of the Koyukuk and Selawik lowlands. The Highlands consists mostly of rounded hills and ridges but includes some mountains higher than 6,000 feet (1,800 m). Parts of the area adjacent to major river valleys are as low as 300 feet (90 m). The higher parts of the mountains have been affected by glaciers, but most of the area has never been ice covered. There are glaciers at present.

The vegetative pattern in this area is complex. In the southern part, forests of white spruce, paper birch, and quaking aspen cover all but the north-facing slopes and foot slopes affected by seep water, up to elevations of about 1,800 feet (540 m). To the north, the upper limit of these forests declines and the range in aspect decreases. In the southern foothills of the Brooks Range, forests occur only on steep south-facing slopes at moderate elevations. Black spruce forests, which are by far the most extensive, occur on all slopes at elevations between 1,800 and 3,000 feet (540 to 900 m) in the south and at a lower range of elevations in the north. They also occupy many foot slopes in the north. Above the black spruce forest the vegetation is alpine tundra, which is principally sedges in poorly drained areas and low shrubs in drier areas. Permafrost is everywhere except under the white spruce-birch-aspen forests in the south. It may be as deep as 6 to 10 feet (2 to 3 m) under shrub tundra in the higher areas and under white spruce-birch-aspen forests in the north.

The climate is continental, characterized by long cold winters and short warm summers (see data for Boundary, Livengood, and Hughes in table 2). Thunderstorms are common in summer, frequently causing wildfires. Precipitation is low to moderate at low elevations, but greater at high elevations.

Mining has been the most important industry, but only a few placer gold mines are still operating. The population is low and is concentrated in the southernmost part, near Fairbanks. A few villages that depend on subsistence hunting and fishing are on major streams. Farming is largely confined to low hills bordering the flood plain of the Tanana River.

Norton Sound Highlands

This area consists of hills and low mountains on the Seward Peninsula and in the area east and south of Norton Sound. Elevations are generally less than 3,000 feet (900 m), though a few peaks are higher. Some mountainous regions on the Seward Peninsula were glaciated, but most of the area has always been free of ice. There are several areas of surface lava flows and low ancient volcanic cones.

Tundra shrubs and sedges cover most of the area. Forests of white spruce and paper birch occupy a narrow strip on the eastern edge of the Highlands, bordering the Yukon River. Forests also cover some areas east and northeast of Norton Sound. Higher areas, commonly above 2,000 feet (600 m), and areas of limestone rock are bare or sparsely vegetated.

There is a significant maritime influence on the climate of the area. Although mean annual temperatures are below freezing, winters are milder and summers are cooler than in inland areas. Precipitation is moderate in the regions bordering Norton Sound but is low in the northern Seward Peninsula and at the eastern edge of the Highlands (see data for Candle, Holy Cross, Nome, and Unalakleet in table 2). Storms in the northern Bering Sea and the Chukchi Sea at times produce winds of sufficient intensity to cause flooding and wave damage in coastal villages.

The population of the area is low. Most inhabitants live in villages and small cities on the coasts or along the Yukon River. The area is heavily mineralized, but mining is much less important as a source of income now than in the early part of the century. Commercial fishing and subsistence hunting and fishing are the principal livelihoods. Several reindeer herds are kept, but there is limited availability of modern slaughtering and meat-handling facilities.

Western Alaska Coastal Plains and Deltas

This area is made up of the Selawik-Kobuk Delta, the Yukon-Kuskokwim Delta, and the Bristol Bay Coastal Plain. All are low and have very little relief. The surface is highly irregular, however, and there are many lakes and ponds connected by a maze of waterways. There are few isolated rocky hills, and low sand dunes are common.

Tundra vegetation, principally mosses, sedges, and low shrubs, covers most areas, but alder, willow, and, in a few places, spruce and birch grow along the major streams. Permafrost underlies nearly all areas except the southern part of the Bristol Bay Coastal Plain. It is deep or absent in sand dunes and natural levees along streams.

A cold maritime climate prevails. Mean air temperatures are well below freezing in the Selawik-Kobuk Delta, especially inland, a few degrees below freezing in the Yukon-Kuskokwim Delta, and slightly above freezing in the Bristol Bay Coastal Plain. Precipitation is low in the Selawik-Kobuk Delta, but moderate elsewhere (see data for Bethel, Kotzebue, and King Salmon in table 2). Spring flooding is common along rivers. Strong winds cause inundation of some coastal areas in winter.

The population is low and is concentrated in small cities and villages on the coast and along major rivers. Commercial fishing is the principal industry, but much of the population depends primarily on subsistence hunting and fishing. Reindeer herds support a few people in the Selawik-Kobuk and Yukon-Kuskokwim Deltas. There is no commercial farming.

Bering Sea Islands

This area includes six islands of the Bering Sea—the Pribilofs (St. George and St. Paul), Nelson, Nunivak, St. Matthew, and St. Lawrence. Except for parts of St. Lawrence and Nelson Islands, the islands are volcanic rock; dormant volcanic cones are prominent features on Nunivak and St. Lawrence Islands. The vegetation is dominantly tundra. Permafrost is everywhere except on the Pribilof Islands.

All of the islands have cool, moist climates (see data for St. Paul, Mekoryuk, and Gambell in table 2). Mean temperatures increase from north to south, and the Pribilofs have mean temperatures well above freezing. Precipitation, which is variable on all the islands, is highest on the windward side of higher hills. Winter storms with gale force winds are common.

The population is low, but only St. Matthew is uninhabited. On the Pribilof Islands the major industry is the annual harvest of fur seals. On Nunivak Island, reindeer are slaughtered commercially and a muskox herd is kept. Reindeer also live on

most of the other islands, but no slaughtering facilities are available. Hunting of sea mammals and fishing are the principal livelihoods. There is no farming.

Brooks Range

This area, the northern extension of the Rocky Mountains, extends across northern Alaska from Canada almost to the Chukchi Sea. The highest part, in the east, has been subject to intense glaciation and is very rugged. The lower western section has smoother, less precipitous slopes, though most of it, too, was formerly covered by glaciers.

The southern slopes of the Brooks Range mark the northern limit of extensive forests in Alaska. A few patches of forest occur at lower elevations within the range. Alpine tundra covers intermediate slopes. Higher areas have essentially no vegetation.

In all but the southern slopes of the range, the climate is arctic (see data for Anaktuvuk Pass in table 2). In most years, freezing temperatures occur every month. Total precipitation is low, but the number of days with some precipitation is high. Heaviest precipitation is on the southern slopes, where the climate is much like that of the Interior Highlands, and near the summits. The least precipitation occurs on the northern slopes. Winds are frequent and strong, especially on the mountain crests.

The population is very low. The village of Anaktuvuk Pass is the only permanent settlement. Subsistence hunting is the chief livelihood.

Arctic Foothills

This is an area of low ridges and intervening swales north and west of the Brooks Range. The elevation is generally less than 2,000 feet (600 m), although some hills close to the Range are as high as 3,500 feet (1,050 m). Except in places directly north of the Range, the area has never been covered by glaciers.

The vegetation over most of the area is treeless tundra. Forests of white spruce, paper birch, and black spruce occur only in the Noatak Valley north of Kotzebue Sound. Permafrost underlies the entire area.

The area has an arctic climate, modified slightly in the western part by maritime influence. Mean annual temperatures everywhere are very low, and frosts may occur in any month. Extremes of temperature in both winter and summer are greater in the area north of the Brooks Range than in the western foothills. Precipitation is very low north of the Brooks Range and only slightly higher in the west, but there are many cloudy days with light rain or snow (see data for Umiat in table 2). High winds occur in winter.

The area is very sparsely populated. Most permanent residents are in the southwestern section. Subsistence fishing and hunting are the principal livelihoods. Reindeer have some importance in the southwestern part of the area. There is no farming, and the small timber resource has not been exploited.

Arctic Coastal Plain

This is a gently rolling treeless area with many shallow elongated lakes and naturally drained lake basins. Rivers flowing from the mountains and foothills to the south meander across the plains to the Arctic Ocean. Sand dunes occur along rivers in the central part of the area and near the coast.

The vegetation is sedges, mosses, low shrubs, and associated tundra plants. Polygonal ground patterns are well developed. The entire area is underlain by permafrost.

The climate is typically arctic, with very low mean annual temperatures (see data for Barter Island, Barrow, and Wainwright in table 2) and very low precipitation rates. Freezing temperatures may occur in any month. Strong winds are common in winter.

The few permanent residents are concentrated in a few settlements along the Arctic Coast. A number of temporary residents are employed in various government projects and in oil and gas production. Subsistence hunting and fishing is important in the economy.

The soil classification system

The Soil Taxonomy of the National Cooperative Soil Survey (*80*), adopted in 1965 after a lengthy trial period, differs from earlier soil classifications in that classes are defined exclusively by properties of the soils themselves rather than external features, such as climate and vegetation. It is recognized, however, that the kind of soil that forms at any point reflects these environmental factors. The properties selected as criteria for classification at the higher levels of the taxonomy are largely those that result from soil-forming processes influenced by the environment, but they are defined in terms of measurable soil characteristics. These are mainly characteristics that can be readily determined in the field, such as color or consistence, but many are properties that can be determined only by laboratory analysis or by repeated measurements. All soil properties used in classification are defined quantitatively.

The Taxonomy groups soil at six levels, or categories. The broadest category is the order. Successively more narrowly defined categories are the suborder, the great group, the subgroup, the soil family, and the soil series. In this exploratory survey, the soils of Alaska are classified at the subgroup level.

A unique feature of the Taxonomy is its nomenclature. Each order is assigned a descriptive syllable that is used as a formative element in developing the names of classes in lower categories. Five orders (of a total of ten in the complete Taxonomy) are represented in Alaska. These orders (described in the section "Soil orders and subgroups in Alaska") and their formative elements are:

Entisols (*ent*)
Histosols (*ist*)
Inceptisols (*ept*)
Mollisols (*oll*)
Spodosols (*od*)

Names of classes in the two categories below the order are formed by adding other syllables that suggest properties emphasized in the Taxonomy. Thus, wet Inceptisols are in the suborder of Aquepts, and Histosols formed mainly from fibrous undecomposed material

are in the suborder of Fibrists. A third syllable is added to form the names of great groups. This syllable for most soils in Alaska is *cry*, indicating cold soil temperature, for example, Cryaquepts or Cryofibrists.

Subgroup names are great group names modified by one or more adjectives. A *typic* subgroup normally represents the central concept, though not necessarily the most extensive soils, of its great group. Other subgroups differ from the Typic in one or more respects, as indicated by the modifying adjective or adjectives. Pergelic Cryaquepts, for example, differ from Typic Cryaquepts in that they have mean annual soil temperatures of 0°C (32°F) or less, hence permafrost at some depth.

Soils are made up of a sequence of layers, or horizons. There are many different kinds of horizons. Some of the more common and distinctive horizons have been selected as diagnostic horizons in classification. In the higher categories of the Taxonomy, definitions of classes are based in large part on the presence, alone or in certain combinations, or absence of these horizons. They are in two groups, diagnostic surface horizons (epipedons) and diagnostic subsurface horizons.

The diagnostic horizons important in the classification of Alaska soils are described briefly in this section, and their properties are summarized. Complete definitions are given in Soil Taxonomy (*80*). It is important to recognize that each horizon is rigorously defined and can be shown quantitatively to be present or absent in any soil.

For descriptions of all pedons referred to on subsequent pages, see "Soil orders and subgroups in Alaska."

Epipedons

Mollic epipedons are relatively thick, dark mineral horizons that are rich in humus and mineral elements, notably calcium and magnesium. The soil within the epipedon is well granulated and friable when moist. Mollic epipedons formed mainly through the incorporation of organic residue into the upper part of the soil and its subsequent decomposition. They must have colors as dark as very dark gray or black when moist and must be measureably darker than the underlying soil or, if the soil parent material is dark, must contain at least 1 percent more organic matter. They may not, however, contain more organic matter than is required in a histic epipedon. Base saturation (the proportion of mineral elements available to plants that is held by the soil, as compared to the soil's capacity to retain such elements) must exceed 50 percent. The mollic epipedon must be at least 7 inches (18 cm) thick. In sand and stratified alluvial material it must be 10 inches (25 cm) thick. Mixing to that depth may be assumed in undisturbed soils with thinner dark horizons. A soil that meets all of the requirements for a mollic epipedon after all horizons to a depth of 7 inches (18 cm) are thoroughly mixed is considered to have a mollic epipedon.

Pergelic Cryaquolls, very gravelly, (pedon 76) and Typic Cryoborolls, loamy, (pedon 77) are representative of soils with mollic epipedons.

Umbric epipedons are identical to mollic epipedons except that base saturation is less than 50 percent. Most soils with umbric epipedons are strongly acid.

Pergelic Cryumbrepts, very gravelly, (pedon 75) are representative of soils with umbric epipedons.

Histic epipedons are highly organic surface horizons that are continuously wet for at least 30 days during the summer. They consist of either organic material or mixed organic and mineral material. In mixed soils, organic matter must exceed 20 percent of the weight of the mineral material in soils with no clay and 30 percent of the weight in soils that are half clay. Proportional percentages of organic matter are required in soils with intermediate clay content. The epipedon must be at least 8 inches (20 cm) thick under ordinary circumstances. As much as 16 inches of mineral material may overlie a histic epipedon as a result of flooding or volcanic ash deposit.

Histic Pergelic Cryaquepts, loamy, (pedons 51 and 54) are representative of soils with histic epipedons.

Ochric epipedons have colors or percentages of organic matter that do not meet the requirements for the other epipedons. In some cases, an ochric epipedon may coexist with a subsurface diagnostic horizon. For example, a section of the soil profile may be recognized as both an ochric epipedon and a cambic horizon.

Typic Cryorthents, loamy, (pedon 11) are representative of soils with ochric epipedons.

Subsurface diagnostic horizons

Argillic horizons are those in which there has been an appreciable increase in clay content as a result of transportation of clay particles from overlying horizons. It is recognized either by an increase in clay percentage as compared with the horizon above or by evidence of clay movement in the form of thin clay deposits (clay skins) on structural aggregates or between sand grains. It must be at least one-tenth the thickness of all overlying horizons, but with a minimum thickness of 6 inches (15 cm) in sand and 3 inches (8 cm) in loamy or clayey soil.

No soils with argillic horizons have been recognized in Alaska, but Alfic Cryochrepts, loamy, (pedon 68) have an incipient argillic horizon in the form of clayey lamellae.

Cambic horizons are those that have been altered in some way and that have lost mineral elements as a result of leaching, but in which the changes with respect to the parent material are relatively slight. Some of the changes that may have taken place are (1) destruction of the original structure of the parent material by plant roots, frost heaving, or animal activity; (2) arrangement of soil particles in aggregates or clusters; (3) chemical alteration of the parent material to form clay-size particles; (4) solution and removal or redistribution of carbonates; (5) chemical liberation of iron and aluminum from the parent material; and (6) segregation of iron oxides in wet soils to form red or brown mottles and streaks. In cambic horizons there is little or no accumulation of material leached from overlying horizons.

The cambic horizon takes several forms, two of which are common in Alaska: (1) In well drained soils with a deep water table, liberation of free iron oxides results in more intense brownish colors than in the unaltered parent material below the cambic horizon. Clay min-

erals may also have been synthesized in this kind of cambic horizon, especially in volcanic ash material. (2) In soils with impeded drainage and a fluctuating water table, free iron oxides are concentrated in mottles or concretions in the parts of the soil that are alternately moist and saturated. The soil between the mottles is normally gray because of the low availability of oxygen during the saturated periods.

Cambic horizons commonly occur directly beneath one of the epipedons, but in some places they can be recognized at the surface of the mineral soil. In this situation, they coexist with ochric epipedons.

No cambic horizon is recognized in sandy material (material in which the percentage of silt plus twice the percentage of clay does not exceed 30) or in material which still exhibits the original structure, including fine stratifications, of the parent rocks or sediment. Also, it is not recognized in soils that are always saturated and that have uniform bluish or greenish colors with no mottling or in soils that contain one of the other subsurface diagnostic horizons.

Pegelic Cryaquepts, loamy, and Typic Cryochrepts, loamy, (pedons 58 and 64) are representative of soils with cambic horizons.

Spodic horizons are those with accumulations of organic matter, aluminum, and iron leached from the upper part of the soil. The horizon is formed by a complex chemical process involving combinations of organic acids from the decomposing litter at the soil surface with iron and aluminum in the upper part of the mineral soil, movement in soluble form within the soil profile, and precipitation in the spodic horizon. Typically, the organic compounds are concentrated in the upper part of the spodic horizon, and much of the iron is carried to greater depth before precipitation. As a result, the upper part of the horizon is commonly black or dark reddish brown, and colors change with depth to reddish brown and yellowish brown.

In most cases, the horizon from which iron has been removed, directly above the spodic horizon, is light gray. This horizon, which is not by itself diagnostic in the classification system, is called an *albic horizon.* The existence of this horizon is helpful in field identification of a spodic horizon, but a spodic horizon can be recognized even if no albic horizon is visible.

Also involved in the formation of a spodic horizon is the synthesis of clay minerals with such weak crystalline structure that they appear to be amorphous. Each clay particle is surrounded by a thick shell of water. In the undisturbed condition, soils containing these clays are fairly rigid, but under pressure the bond between the clay and its surrounding water is broken and the soil becomes loose and watery. On release of the pressure, the original rigidity is restored. This property, called thixotropy, exists to some extent in all spodic horizons, but is much less noticeable in sandy than in loamy material.

The amorphous clays in spodic horizons are commonly difficult to distinguish in the field from similar —but not identical—clays in cambic horizons developed in fine volcanic material. Chemical tests are needed for positive identification.

Dystric Lithic Cryandepts, very gravelly, and Entic Cryorthods, sandy, (pedons 43 and 98) are representative of soils with spodic horizons.

Placic horizons are very thin brittle pans cemented by iron, manganese, or an iron-organic matter complex. Commonly the pan is a single undulating sheet of indurated material that contains two layers with different cementing agents. In Alaska, placic horizons form only in areas of very high rainfall. They occur in association with spodic horizons or at the base of thick accumulations of sphagnum moss on rolling uplands.

Placic Haplaquods, very gravelly, (pedon 86) are representative of soils with placic horizons.

Fragipans are very firm, compact horizons that are hard when dry and brittle when moist. If shattered, they break into angular prismatic or blocky fragments. In Alaska, fragipans normally underlie a spodic horizon or organic material. They form only in glacial till. They are slowly permeable to water. In many places water is perched above the pan. On slopes, water moving laterally above the fragipan may result in a light gray horizon at its surface.

Cryic Fragiorthods, very gravelly, (pedon 107) are representative of soils with fragipans.

Pedon descriptions

The smallest soil unit that can be identified is a three-demensional body called a pedon. Its lower limit coincides with either the maximum depth affected by soil-forming processes or the maximum depth of rooting of the native vegetation, whichever is deeper. Where soil horizons are continuous and of uniform thickness, the surface area is one square meter (about 11 square feet). Where horizons are intermittent or occur in a repetitive or cyclic pattern, the pedon is large enough to include the entire range of horizon variations but is never larger than 10 square meters (about 110 square feet). Descriptions and samples of representative pedons are used to characterize larger soil areas.

The properties of a pedon are recorded, normally, by describing each of its component horizons. In addition to detailed written descriptions, the horizons are identified by letters and numerals that indicate how they differ from the original, or parent, material, and that suggest genetic relationships among them. Master horizons recognized in pedon descriptions commonly coincide with the diagnostic horizons used in the Soil Taxonomy.

Mineral soils

Any or all of five master horizons, designated by capital letters, may be identified in pedon descriptions of mineral soils. Each of these may have two or more subdivisions, identified by Arabic numerals. The master horizons and subdivisons are briefly defined in the paragraphs that follow.

An *O horizon* is an organic horizon at the surface. The minimum percentage of organic matter ranges from 20 in the sandy soils to 30 in soils that are dominantly clay.

O1 indicates an organic horizon in which the original form of vegetative matter is visible to the naked eye.

O2 indicates an organic horizon in which the

organic material has decomposed to the extent that the original form is not visible.

An *A horizon* is a mineral horizon at or near the surface in which organic matter has accumulated or a horizon that has lost clay, iron, or aluminum as a result of leaching.

A1 indicates a surface horizon in which humified organic matter has accumulated in close association with the mineral material.

A2 indicates a horizon in which there has been loss of clay, iron, or aluminum. An A2 horizon generally is lighter in color than an underlying B horizon.

A3 indicates a horizon transitional between the A and B horizons, but with properties dominantly those of an overlying A1 or A2 horizon.

A *B horizon* is a mineral horizon with one or more of the following: (1) an accumulation of clay, iron, aluminum, or humus as a result of translocation from an overlying horizon; (2) a residual concentration of iron and aluminum oxides or of silicate clays, or both, provided that this is not the result solely of solution and removal of carbonates or other soluble salts; (3) conspicuously darker, stronger, or redder colors than overlying or underlying horizons, as a result of coatings of iron oxide on mineral grains or aggregates; or (4) any other alteration of the original material that obliterates the original rock structure, forms silicate clays, or liberates iron or aluminum oxides.

B1 indicates a horizon transitional between the A and B horizons, but with properties dominantly those of an underlying B2 horizon.

B2 indicates a horizon with no clearly expressed subordinate properties associated with an overlying A horizon or an underlying C or R horizon.

B3 indicates a horizon transitional between the B and C horizons, but with properties dominantly those of an overlying B2 horizon.

A *C horizon* is one relatively unaffected by soil-forming processes influenced by the activity of organisms. It can consist of (1) material modified by geologic weathering, (2) compacted or reversibly cemented material, (3) accumulations in either soft or cemented form of carbonates or other soluble salts, or (4) siliceous cemented material. Subhorizons within the C horizon are numbered consecutively.

An *R horizon* is the underlying bedrock.

Various other horizon designations are also used. The capital letters *AB* may be used in the case of transitional horizons that are too thin to be separated into A3 and B1 horizons. The letters *AC* are used to indicate a horizon transitional between the A and C horizons. Each of the defined subhorizons may be further subdivided, in which case a second numeral (numbered consecutively from the top of the subhorizon) is added to the subhorizon designation. Lower case letters may be added to the designation to indicate more specifically the kind of modification of the parent material that has taken place. The lower case symbols that are commonly used in this survey are—

b - A soil horizon buried under material that may or may not be similar to the parent material of the buried soil.

ca - An accumulation of carbonates, commonly of calcium.

f - Perennially frozen soil.

g - Gleying, or gray colors and mottles resulting from the presence of stagnant water during soil development.

h - Heavy accumulation of organic matter translocated from the A horizon to the B horizon.

ir - Heavy accumulation of iron oxide as a result of translocation.

m - Strong irreversible cementation.

p - Disturbance by plowing or cultivation.

x - Genetically developed firmness, brittleness, or high density in a B or C horizon; a fragipan.

Roman numerals, beginning with II, indicate lithologic discontinuities within the pedon. The numeral I for the uppermost material is assumed. The Roman numeral precedes the horizon designation and is used independently of the other conventional symbols.

Pedon descriptions follow a standard format. Horizons are arranged in order from the surface of the pedon downward. Following the horizon designation and the depth, each horizon is described in terms of (1) color (moist); (2) texture, or relative proportions of gravel, sand, silt, and clay; (3) structure, or the cohesiveness, size, and shape of aggregates or clusters; (4) consistence (moist), or degree of compaction and plasticity; (5) plant root content; (6) porosity; (7) reaction, or degree of acidity or basicity; and (8) the distinctness and shape of the lower boundary. Any special features are also noted.

Organic soils

All organic horizons are designated by the capital letter *O* and a lower case letter that indicates the degree of decomposition of the organic material. The horizon designations used in this survey are—

Oi indicates mostly undecomposed or slightly decomposed fibrous material. Normally, more than two-fifths by volume of the material after rubbing consists of fibers that are readily identifiable under magnification.

Oe indicates partially decomposed organic material. Between one-sixth and two-fifths by volume of the material after rubbing consists of identifiable fibers.

Oa indicates well decomposed organic material. Less than one-sixth by volume of the material after rubbing consists of identifiable fibers.

Subhorizons are identified by consecutive numerals, from the surface downward. In stratified organic soils, numerals are concurrent, for example, Oi1–Oe1–Oe2–Oa1–Oe3–Oa2. Mineral layers above, within, or below the organic material are designated in the same way as mineral soils. Roman numerals are not used to indicate discontinuities. The lower case letter *f* indicates a perennially frozen soil.

Soil orders and subgroups in Alaska

Each soil order, suborder, and subgroup recognized in Alaska is described in general terms on the pages

that follow. Descriptions of pedons representative of the subgroups are included. Analytical data for many of these pedons are listed in table 3. Phases of subgroups and miscellaneous areas that are components of map units are described under the individual map units. Acreages of each component, by major land resource area, are shown in table 4.

Entisols

In Entisols there is little or no evidence of change as a result of soil-forming processes. Most of them have no diagnostic horizons other than an ochric epipedon. Wet mineral soils are classified as Entisols, however, if they have no cambic horizon but have a histic epipedon that consists entirely of organic material. In Alaska, Entisols occur most commonly (1) on flood plains and outwash plains which receive new deposits of sediment at frequent intervals, (2) on uplands adjacent to major rivers where new material blown from the river beds is deposited, (3) in other young material, such as recently exposed glacial moraines, and (4) in very cold or very steep areas where vegetation is sparse, where soils are unstable, or where parent material is exceptionally resistant to chemical weathering.

Aquents

Aquents are the wet Entisols. They occur south of the permafrost zone in areas that are constantly saturated by glacial meltwater, in parts of flood plains where the water table is high most of the time, on foot slopes affected by seepage, and in coastal marshes. The vegetation is principally sedges, willows, black spruce, and other water-tolerant plants, but in a few places the soils support Sitka spruce, western hemlock, white spruce, paper birch, or cottonwood.

Typic Cryaquents have a wide range of properties apart from their common characteristic of wetness. The texture ranges from very gravelly sand to fine clay. Many of the soils are stratified, but some have no apparent layering. Colors range from gray or bluish gray with no mottling to grayish brown or olive gray with strong mottling. The water table may be always close to the surface, or it may fluctuate. The soils may be unfrozen throughout the year or remain frozen well into summer, but none are perennially frozen at any depth. Some of the soils have fairly thick accumulations of peaty material on the surface. The soils do not, however, have a thick upper horizon in which a substantial amount of organic matter is mixed with mineral material.

Extensive areas of Typic Cryaquents occur at the mouths of receding glaciers along the coast of the Gulf of Alaska and on the south and east slopes of the Alaska Range. These soils consist mostly of stratified sand or sand and gravel and are nearly always saturated. Low brushy vegetation dominates most areas, but strips of forest border some incised stream channels.

Pedon *1*, Typic Cryaquents, sandy (Stave series). Near Gustavus.

O1—1½ inches to 0 (4–0 cm); dark reddish brown (5YR 2/2) mat of organic material; many roots; clear smooth boundary.

C1—0 to 5 inches (0–12 cm); dark gray (5Y 4/1) medium sand; many olive gray (5Y 4/2) sand grains; single grain; loose; few roots; water table at surface; mildly alkaline; gradual boundary.

C2g—5 to 18 inches (12–45 cm); dark gray (5Y 4/1) medium sand; few fine faint mottles of yellowish brown (10YR 5/6); single grain; loose; moderately alkaline; gradual boundary.

C3g—18 to 20+ inches (45–50+ cm); dark gray (5Y 4/1) layered medium sand and fine sand; few coarse prominent mottles of reddish brown (5YR 5/4); single grain; loose; moderately alkaline (below 20 inches, soil is too wet to bring up with auger or spade, but no gravel or stones occur).

On flood plains or slopes affected by seepage, Typic Cryaquents are generally stratified. Many have a fluctuating water table and support forests of white spruce, paper birch, and cottonwood. Some are covered with dense stands of tall grass.

Pedon *2*, Typic Cryaquents, loamy (Killey series). About 11 miles (18 km) west of Talkeetna (*59*).

O1—2 inches to 0 (5–0 cm); dark reddish brown (5YR 2/2) mat of decomposing organic material; many fine roots; very strongly acid; abrupt wavy boundary.

A1—0 to 3 inches (0–8 cm); dark brown (7.5YR 3/2) silt loam; a few, medium, faint, dark grayish brown (10YR 4/2) mottles; weak fine granular structure; very friable; many roots; very strongly acid; abrupt wavy boundary.

C1—3 to 10 inches (8–25 cm); olive brown (2.5Y 4/4) silt loam; common, medium, faint, dark grayish brown (10YR 4/2) mottles and common fine distinct brown (7.5YR 4/4) mottles; weak fine subangular blocky structure; very friable; a few thin strata of fine sand; common roots; very strongly acid; gradual boundary.

C2—10 to 26 inches (25–65 cm); olive brown (2.5Y 4/4) fine sandy loam; patches of dark grayish brown (2.5Y 4/2) make up about 50 percent of the horizon; common medium distinct brown (7.5YR 4/4) mottles; weak fine subangular blocky structure; very friable; a few roots; very strongly acid; clear smooth boundary.

C3—26 to 36 inches (65–90 cm); dark grayish brown (2.5Y 4/2) fine sand; a few thin strata of silt; single grain; loose; very strongly acid; clear smooth boundary.

IIC4—36 to 44 inches (90–110 cm); olive gray (5Y 4/2) gravelly coarse sand; single grain; loose.

Soils on foot slopes may be wet because of seep water perched above a slowly permeable substratum. In many places, the seepage can be controlled easily by simple drainage and diversion systems.

Pedon *3*, Typic Cryaquents, loamy (Beluga series). About 1 mile (1.6 km) east of Homer (*30*).

O1—5 inches to 0 (12–0 cm); dark reddish brown (5YR 2/2) mat of partly decomposed straw and woody material; mycelia in lower part of horizon.

A1—0 to 2 inches (0–5 cm); very dark grayish brown (10YR 3/2) silt loam and pockets of dark grayish brown (10YR 4/2) silt loam; moderate fine granular structure; very friable; common roots; streaks of burned organic matter near bottom of horizon; strongly acid; abrupt wavy boundary.

C1—2 to 8 inches (5–20 cm); dark grayish brown (10YR 4/2) silt loam; common medium distinct mottles of dark yellowish brown (10YR 4/4); moderate fine granular structure; very friable; common roots; medium acid; abrupt wavy boundary.

C2—8 to 13 inches (20–32 cm); dark grayish brown (10YR 4/2) fine sandy loam; common coarse distinct mottles of dark yellowish brown (10YR 4/4); weak thin platy structure; very friable; common roots; medium acid; abrupt wavy boundary.

C3—13 to 21 inches (32–52 cm); gray (5Y 5/1) silt loam; common, medium, distinct mottles of dark yellowish brown (10YR 4/4); weak thin platy structure that parts to weak, fine, angular blocky structure; friable; few roots; thin seams of fine sandy loam; medium acid; abrupt wavy boundary.

C4—21 to 27 inches (52–68 cm); greenish gray (5GY

TABLE 3.—*Physical and chemical*

Pedon number[1]	Depth	Horizon	Particle-size distribution				Moisture tension		pH 1:1 H_2O	Organic carbon	Nitrogen
			Sand (2–.05 mm)	Silt (.05–.002 mm)	Clay (less than .002 mm)	Gravel (2–76 mm)	⅓ bar	15 bar			
	Cm		*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*		*Pct*	*Pct*
4	0–15	O1	—	—	—	—	—	—	6.2	—	—
	15–30	C1	—	—	—	—	—	—	7.5	—	—
	30+	C2	—	—	—	—	—	—	8.6	—	—
11	0–8	C1	5.4	89.9	4.7	—	—	16.2	5.0	9.62	0.423
	8–20	C2	16.9	78.1	5.0	—	—	9.7	5.3	5.52	0.218
	20–68	C3	13.4	82.5	4.1	—	—	6.6	5.5	2.98	0.120
	68–90	C4	20.0	75.1	4.9	Tr.	—	6.6	5.8	1.13	0.058
	90–120	IIC5	84.3	12.8	2.9	50.9	—	2.6	6.0	0.27	0.009
40[2]	8–0	O1	—	—	—	—	—	—	4.4	21.+	0.336
	0–2	C1	30.2	65.2	4.6	—	0	18.3	4.4	8.45	0.247
	2–5	C2	27.6	70.0	2.4	—	—	10.1	4.7	5.35	0.163
	5–6	O2b	(No analysis of this horizon)								
	6–12	A1b	33.0	55.9	11.1	—	—	13.1	4.8	7.09	0.214
	12–17	B21b	30.9	56.2	12.9	Tr.	—	19.8	4.7	8.87	0.509
	17–27	B22b	30.4	58.4	11.2	Tr.	—	16.4	5.1	5.96	0.376
	27–34	B3b	32.6	59.2	8.2	Tr.	—	13.6	5.1	3.50	0.263
	34–42	C1b	30.4	60.0	9.6	Tr.	—	11.5	5.2	3.20	—
	42–57	IIC2	21.0	66.6	12.4	Tr.	—	9.6	5.3	1.69	—
	57–72	IIIC3	23.5	61.9	14.6	Tr.	—	11.1	5.0	0.48	—
41[2,3]	22–12	O1	—	—	—	—	—	148	3.8	46.28	2.860
	12–0	O2	21.0	55.2	23.8	—	206	82.9	3.5	33.51	2.295
	0–6	A11	—	—	—	12	190	37.1	4.0	13.73	0.834
	6–16	A12	—	—	—	—	156	32.4	4.2	10.49	0.681
	16–28	A11b	31.6	53.8	14.6	14	225	24.6	4.3	8.71	0.559
	28–38	A12b	—	—	—	3	256	41.7	4.2	13.47	0.725
	38–50	B21	—	—	—	7	132	24.5	4.6	9.24	0.493
	50–66	B22	25.6	67.7	6.7	13	207	33.1	4.7	9.48	0.512
	66–83	IIC1	—	—	—	63	32.1	4.1	5.2	0.65	0.042
51	18–8	O11	—	—	—	—	—	—	5.7	29.1	1.87
	8–0	O12	—	—	—	—	—	—	5.4	26.0	1.86
	0–3	B21g	—	—	—	—	—	—	4.9	5.1	.31
	3–23	B22g	32.2	40.9	26.9	—	—	—	4.7	4.6	.28
	23–28	C1f	—	—	—	—	—	—	4.8	9.7	.58
	28–46	C2f	34.0	33.9	32.1	—	—	—	4.9	8.5	.52
54	0–10	B21g	41.0	42.4	16.6	—	—	—	5.5	0.6	0.02
	10–18	B22g	45.1	39.5	15.5	—	—	—	5.6	0.6	0.02
	18–33	C1f	44.2	43.6	12.2	—	—	—	5.9	1.0	0.04
55	0–16	B21g	8.0	28.3	63.7	—	—	—	6.3	1.2	0.07
	16–32	B21g	4.0	20.4	74.6	—	—	—	6.9	0.7	0.04
	32–48	C1f	12.0	22.8	75.2	—	—	—	7.6	—	0.03
	48–82	C1f	5.0	8.4	86.6	—	—	—	7.6	—	0.03
	82–85	C2f	42.1	43.3	14.7	—	—	—	7.9	—	0.03
	85–110	C3f	49.3	31.3	18.7	—	—	—	8.1	—	0.01
	110–115	C4f	13.8	56.2	29.8	—	—	—	8.4	—	0.02
58	12–0	O1	—	—	—	—	—	—	5.4	36.38	1.212
	0–8	A1	8.2	76.4	15.4	—	—	18.9	5.7	11.51	0.399
	8–28	B21	3.8	79.6	16.6	—	—	8.6	6.9	1.62	0.081
	28–52	B22	3.9	80.4	15.7	—	—	7.0	7.7	0.70	0.054
	52–72	C1	16.0	75.6	8.5	—	—	4.6	7.8	0.36	0.034
67	0–8	A1	18.0	75.0	7.0	—	—	10.0	5.3	4.29	0.19
	8–18	A2	20.4	72.0	7.6	Tr.	—	6.5	5.4	1.60	0.08
	18–22	B21	21.4	69.6	9.0	Tr.	—	6.4	5.7	0.75	0.06
	22–32	B22	24.4	66.9	8.7	Tr.	—	6.2	6.0	0.40	0.03
	32–50	B3	24.8	71.7	3.5	Tr.	—	3.9	6.5	0.21	0.02
	50–75	IIC1	79.6	12.8	7.6	83	—	3.8	6.7	0.12	0.01

analyses of selected pedons

C/N ratio	Extractable Fe	Extractable Al	Extractable cations (milliequivalents per 100 grams of soil)					Extractable acidity	Cation exchange capacity		Base saturation	
			Ca	Mg	Na	K	Sum		NH_4OAc	Sum	NH_4OAc	Sum
	Pct	*Pct*						*Meq/100 gm*	*Meq/100 gm*	*Meq/100 gm*	*Pct*	*Pct*
——	——	——	5.9	8.3	——	0.5	——	6.4	——	21.1	——	70
——	——	——	7.8	6.4	——	0.3	——	1.6	——	16.2	——	90
——	——	——	11.1	2.5	——	0.5	——	0.0	——	14.2	——	100
23	0.8	——	17.1	4.2	——	0.6	21.9	24.6	30.9	46.5	71	47
25	1.3	——	11.2	2.4	——	0.4	14.0	19.0	21.8	33.0	64	42
25	1.3	——	7.8	1.9	0.1	0.2	10.0	11.2	14.1	21.2	71	47
20	2.0	——	7.2	1.9	0.1	0.4	9.6	10.4	12.8	20.0	75	48
30	0.6	——	3.1	0.8	——	0.3	4.2	3.6	5.7	7.8	74	54
62	——	——	——	——	——	——	——	——	——	——	——	——
34	0.2	1.9	1.5	0.7	0.2	0.5	2.9	24.6	17.4	27.5	17	10
33	0.7	2.4	1.2	0.4	0.2	0.2	2.0	41.1	17.2	43.1	12	5
(No analysis of this horizon)												
33	0.8	3.1	2.7	1.4	0.2	0.1	4.4	35.9	22.4	40.3	20	11
17	2.0	5.1	2.3	0.8	0.2	0.1	3.4	76.9	35.4	80.3	10	4
16	1.7	3.6	1.6	0.3	0.2	<0.1	2.1	59.3	25.3	61.4	8	3
13	1.3	3.0	1.1	0.4	0.1	<0.1	1.6	43.3	19.9	44.9	8	4
——	1.0	3.2	1.0	0.4	0.1	<0.1	1.5	38.4	18.4	39.9	8	4
——	0.6	3.7	1.1	0.7	0.1	<0.1	1.9	26.6	14.6	28.5	13	7
——	0.6	6.0	4.9	2.4	0.2	0.1	7.6	19.9	17.5	27.5	43	28
16	0.2	3.1	5.5	4.5	0.6	1.6	12.2	114.0	119.7	126.2	10	10
15	2.1	19.4	0.7	0.7	0.4	0.5	2.3	123.5	115.5	125.8	2	2
16	5.7	8.4	Tr.	0.1	0.3	0.1	0.5	96.4	71.3	96.9	1	1
15	4.2	5.1	Tr.	0.1	0.3	0.1	0.5	82.4	57.4	82.9	1	1
16	3.4	4.7	Tr.	Tr.	0.3	0.1	0.4	74.1	46.8	74.5	1	1
19	6.4	4.2	Tr.	Tr.	0.4	0.1	0.5	99.1	88.4	99.6	1	1
19	4.0	2.2	Tr.	Tr.	0.3	0.1	0.4	76.4	58.0	76.8	1	1
19	5.0	.4	Tr.	0.1	0.2	0.1	0.4	70.0	62.4	70.4	1	1
15	0.8	.5	Tr.	Tr.	0.1	0.1	0.2	10.9	7.1	11.1	3	2
16	——	——	40.5	5.8	0.2	——	46.5	61.7	——	108.2	——	43
14	——	——	7.0	2.5	——	——	9.5	64.3	——	73.8	——	13
16	——	——	8.4	1.6	——	——	10.0	18.4	——	28.4	——	35
16	——	——	5.6	2.0	——	——	7.6	10.5	——	18.1	——	42
17	——	——	10.2	1.7	——	——	11.9	24.3	——	36.2	——	33
16	——	——	8.5	3.2	——	——	11.7	23.6	——	35.3	——	33
30	——	——	5.5	4.8	0.08	0.15	10.5	4.3	14.3	18.6	79	56
30	——	——	4.5	4.5	0.07	0.13	9.2	4.1	11.1	15.2	83	61
25	——	——	3.6	3.2	0.05	0.15	7.0	4.4	9.9	13.6	71	51
17	——	——	20.6	8.0	0.11	0.47	29.2	7.0	36.0	43.0	81	68
17	——	——	21.6	8.7	0.14	0.43	30.9	5.0	35.6	40.6	87	76
——	——	——	——	——	——	——	——	——	——	——	——	——
——	——	——	——	——	——	——	——	——	——	——	——	——
——	——	——	——	——	——	——	——	——	——	——	——	——
——	——	——	——	——	——	——	——	——	——	——	——	——
——	——	——	——	——	——	——	——	——	——	——	——	——
30	——	——	——	——	——	——	——	——	——	——	——	——
29	1.9	——	24.3	11.8	0.3	0.5	36.9	27.2	40.5	64.1	91	58
20	1.7	——	14.7	7.6	0.4	0.1	22.8	6.4	22.3	29.2	100+	78
13	1.5	——	13.6	5.6	0.3	0.1	19.6	2.8	18.4	22.4	100+	88
10	1.1	——	9.8	3.4	0.2	0.1	13.5	1.6	11.9	15.1	100+	89
22	1.7	——	7.9	3.9	0.1	0.4	12.3	18.8	20.4	31.1	60	40
19	1.9	——	5.8	2.3	0.1	0.2	8.4	11.5	13.7	19.9	61	42
14	1.9	——	5.3	3.0	0.1	0.1	8.5	7.9	11.8	16.4	72	52
13	1.9	——	6.7	3.8	0.1	0.1	10.7	4.8	11.2	15.5	96	69
10	0.9	——	5.6	3.4	0.1	0.1	9.2	2.8	9.1	12.0	100+	77
15	0.7	——	3.1	1.8	0.1	0.1	5.1	1.2	5.0	6.3	100+	81

TABLE 3.—*Physical and chemical*

Pedon number [1]	Depth	Horizon	Particle-size distribution				Moisture tension		pH 1:1 H_2O	Organic carbon	Nitrogen
			Sand (2–.05 mm)	Silt (.05–.002 mm)	Clay (less than .002 mm)	Gravel (2–76 mm)	⅓ bar	15 bar			
	Cm		*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*		*Pct*	*Pct*
68	0–8	A1	6.2	83.6	10.2	——	——	9.6	5.7	3.21	0.183
	8–15	A2	6.2	84.0	9.8	——	——	7.1	5.8	0.95	0.066
	15–38	B2	6.6	81.6	11.8	——	——	7.3	6.1	0.79	0.050
	——	A2	8.8	82.6	8.6	——	——	5.3	6.2	0.39	0.029
	——	Bt	6.9	70.4	22.7	——	——	9.8	6.1	0.72	0.048
	38–65	B3	24.3	71.1	4.6	——	——	4.1	6.5	0.29	0.019
	65–100	C1	41.7	55.1	3.2	——	——	3.5	6.5	0.24	——
	100–130	C2	32.4	63.3	4.3	Tr.	——	3.3	6.6	0.24	——
75 [5]	2–0	O2	——	——	——	17	——	62.2	5.3	29.8	0.855
	0–8	A11	28.3	58.5	13.2	53	——	16.2	4.5	7.81	0.347
	8–15	A12	25.6	60.7	13.7	41	——	11.7	4.5	4.71	0.249
	15–30	B	18.9	66.9	14.2	38	——	8.2	4.8	0.98	0.113
	30–51	C1	14.8	69.3	15.9	36	——	8.3	5.2	0.39	0.061
	51–71	C2	13.0	71.2	15.8	29	——	9.8	5.1	1.51	0.102
78 [5]	4–0	O2	——	——	——	Tr.	——	76.9	5.5	33.1	1.35
	0–5	A11	13.0	56.3	30.7	5	——	37.1	6.5	16.6	0.841
	5–13	A12	30.2	49.7	20.1	38	——	13.2	5.9	3.95	0.262
	13–33	B	38.3	44.1	17.6	27	——	10.1	6.2	1.32	0.102
	33–51	C	35.9	47.2	16.9	26	——	8.8	6.4	0.48	0.043
86	0–5	A2	24.3	54.7	21.0	30	——	14.2	4.2	4.46	0.160
	5–10	B21h	39.4	39.8	20.8	60	——	33.4	4.8	7.64	0.268
	10–25	B22h	44.7	36.3	19.0	90	——	32.5	4.6	5.27	0.173
	25–32	B3	58.7	26.9	14.4	80	——	15.0	——	2.21	0.070
	32–34	B2irm	72.9 [6]	20.0	7.1	70	——	8.5	5.0	2.10	0.063
	34–65	C1x	82.9	10.6	6.5	90	——	8.3	5.4	0.70	0.029
	65–118	C2x	77.8	14.4	7.8	90	——	7.1	5.5	0.43	0.023
87 [5 2]	10–0	O1	——	——	——	——	——	123	3.6	42.52	0.997
	0–5	A2	36.4	57.5	6.1	——	64.8	19.0	3.7	9.98	0.282
	5–12	B21	51.4	41.2	7.4	20	72.0	23.5	4.6	11.77	0.379
	12–22	B22	——	——	——	27	49.0	16.5	4.9	6.66	0.223
	22–32	B3	——	——	——	21	19.3	6.5	5.5	1.31	0.055
	32–57	IIC1	66.8	31.1	2.1	57	——	2.5	5.8	0.17	——
88 [7 2]	8–0	O1	——	——	——	——	——	113.0	——	38.03	2.284
	0–3	A2	57.5	38.0	4.5	——	——	56.0	3.3	15.94	1.086
	3–10	A11	53.3	42.8	3.9	——	——	48.5	3.4	23.45	1.495
	10–16	A12	——	——	——	——	——	49.0	3.8	19.68	1.108
	16–25	A13	46.9	49.7	3.4	——	——	31.0	4.1	11.32	0.579
	25–38	A1b	——	——	——	——	——	54.8	4.1	22.20	0.992
	38–46	Cb	38.3	53.4	8.3	——	——	18.1	4.5	5.58	0.304
90 [5 2]	25–8	O1	——	——	——	——	——	94.4	3.6	50.69	0.765
	8–0	O2	——	——	——	——	231.	74.4	3.6	49.03	0.791
	0–5	A2	40.8	51.6	7.6	11	52.5	7.0	4.1	5.11	0.084
	5–8	A3	——	——	——	19	——	14.2	4.0	6.86	0.152
	8–20	B21h	50.6	38.9	10.5	26	210	30.0	4.2	18.12	0.445
	20–30	B22h	——	——	——	5	258	36.4	4.5	17.28	0.342
	30–33	B23irm	——	——	——	——	216	32.6	5.0	11.67	0.225
	33–56	B31	——	——	——	——	338	21.4	5.5	4.26	0.137
	56–91	B32	——	——	——	——	——	18.1	5.6	3.11	0.112
	91–185	B33	30.3	44.3	25.4	——	272	17.8	5.6	2.75	0.109
	185–229	C	——	——	——	——	——	8.9	6.5	0.83	0.033
91 [5 2]	8–0	O12	——	——	——	——	——	——	4.2	36+	0.230
	0–8	A2	35.9	56.7	7.4	——	——	10.9	3.8	7.53	0.070
	8–15	B21	32.6	59.1	8.3	Tr.	——	13.2	4.8	8.14	0.155
	15–25	B22	29.8	60.7	9.5	4	——	12.8	5.1	4.30	0.211
	25–45	B3	28.1	64.9	7.0	8	——	9.2	5.2	2.04	0.138
	45–62	C1	29.5	65.1	5.4	17	——	5.4	5.3	0.98	——
	62–105	IIC2	54.6	43.3	2.1	38	——	——	5.4	0.33	——
	105–125	IIC3	——	——	——	70	——	——	5.3	0.21	——

analyses of selected pedons—Continued

C/N ratio	Extractable Fe	Extractable Al	Extractable cations (milliequivalents per 100 grams of soil)					Extractable acidity	Cation exchange capacity		Base saturation	
			Ca	Mg	Na	K	Sum		NH_4 OAc	Sum	NH_4 OAc	Sum
	Pct	*Pct*						*Meq/100 gm*	*Meq/100 gm*	*Meq/100 gm*	*Pct*	*Pct*
18	1.4	——	12.7	4.4	Tr.	0.3	17.4	10.1	20.4	27.5	85	63
14	1.4	——	9.4	4.0	Tr.	0.2	13.6	6.5	15.8	20.1	86	68
16	1.5	——	8.8	4.7	0.1	0.2	13.8	6.2	15.3	20.0	90	69
13	1.2	——	6.6	4.3	0.1	0.1	11.1	3.6	11.7	14.7	95	76
15	2.2	——	10.2	7.0	0.1	0.2	17.5	7.0	18.5	24.5	94	71
15	1.0	——	4.6	4.2	0.1	0.1	9.0	2.8	9.4	11.8	96	76
——	0.9	——	3.9	3.9	0.1	0.1	8.0	2.1	8.2	10.1	98	79
——	0.9	——	3.9	4.8	0.1	0.1	8.9	2.1	8.9	11.0	100	81
35	1.0	——	6.8	5.1	0.4	1.3	13.6	——	45.7	——	30	——
23	1.5	——	0.6	0.7	0.2	0.3	1.8	33.6	20.0	35.4	9	5
19	1.6	——	0.1	0.5	0.1	0.1	0.8	36.0	16.0	36.8	5	2
9	1.5	——	0.3	0.5	0.1	0.1	1.0	22.5	13.0	23.5	8	4
6	1.4	——	1.8	1.1	0.3	0.2	3.4	15.0	12.7	18.4	27	18
15	1.9	——	0.3	0.5	0.1	0.1	1.0	21.2	12.0	22.2	8	4
25	1.2	——	45.5	23.4	1.1	1.7	71.1	——	81.9	——	87	——
20	2.1	——	29.9	15.6	0.6	0.7	46.8	33.8	56.0	80.6	84	58
15	2.4	——	14.6	10.2	0.4	0.5	25.7	18.6	33.3	44.3	77	58
13	2.3	——	9.6	7.9	0.3	0.3	18.1	9.6	22.5	27.7	80	65
11	2.2	——	9.6	6.9	0.3	0.3	17.1	5.3	19.7	22.4	87	76
28	0.5	——	——	0.4	0.2	0.2	0.8	40.0	24.9	40.8	3	2
28	1.4	——	——	0.3	0.3	0.2	0.8	63.7	33.3	64.5	2	1
30	1.0	——	——	0.1	0.2	0.1	0.4	59.0	23.5	59.4	2	1
32	0.6	——	Tr.	0.2	0.1	0.1	0.4	28.6	10.6	29.0	4	1
33	5.6	——	Tr.	——	Tr.	Tr.	——	31.8	12.8	31.8	——	——
24	0.8	——	0.1	——	0.1	0.1	0.3	12.9	4.5	13.2	7	2
19	0.7	——	Tr.	——	Tr.	Tr.	——	7.8	3.3	7.8	——	——
43	0.3	——	8.5	3.1	0.3	1.8	13.7	89.2	95.6	102.9	14	13
35	0.4	——	0.1	0.2	0.2	0.2	0.7	34.1	24.1	34.8	3	2
31	1.4	2.5	0.1	0.1	0.1	0.1	0.4	75.9	61.8	76.3	1	1
30	1.4	2.4	0.3	0.1	0.1	0.1	0.6	60.0	43.6	60.6	1	1
24	1.0	——	0.7	0.1	0.2	0.1	1.1	20.4	11.5	21.5	10	5
——	0.6	0.1	0.6	0.1	0.2	0.1	1.0	4.6	4.2	5.6	24	18
17	0.2	——	4.5	4.4	0.3	1.6	10.8	90.4	98.2	101.2	11	11
15	0.3	——	0.6	0.7	0.2	0.7	2.2	50.6	42.2	52.8	5	4
16	2.6	——	0.9	0.7	0.2	0.5	2.3	140.1	91.0	142.4	3	2
18	3.8	——	0.2	0.3	0.2	0.3	1.0	145.5	93.0	146.5	1	1
20	2.2	——	0.2	0.1	0.2	0.1	0.6	85.8	58.0	86.4	1	1
22	7.3	——	0.2	0.2	0.1	0.1	0.6	107.1	93.2	107.7	1	1
28	2.7	——	0.4	0.2	0.1	Tr.	0.7	51.1	37.6	51.8	2	1
66	0.1	——	8.8	10.5	1.6	1.2	22.1	121.5	137.3	143.6	16	15
62	0.3	——	5.8	6.5	1.3	0.5	14.1	91.6	145.4	105.7	10	13
61	0.3	——	0.1	0.3	0.1	0.1	0.6	16.7	12.2	17.3	5	3
45	0.2	——	0.1	0.2	0.1	0.1	0.5	56.5	35.9	57.0	1	1
41	1.1	2.5	0.1	0.4	0.2	0.1	0.8	100.5	92.8	101.3	1	1
51	0.4	4.3	0.1	0.3	0.3	0.1	0.8	134.9	107.2	135.7	1	1
52	10.9	3.1	0.1	0.1	0.2	0.1	0.5	103.4	76.2	103.9	1	0
31	3.4	1.5	Tr.	Tr.	0.1	Tr.	0.1	64.0	44.9	64.1	0	0
28	3.1	——	Tr.	0.1	0.2	0.1	0.4	61.7	37.9	62.1	1	1
25	2.7	1.2	Tr.	0.1	0.2	0.1	0.4	53.6	33.1	54.0	1	1
25	0.9	0.4	0.2	0.3	0.5	0.2	1.2	21.4	13.6	22.6	9	5
156	——	——	——	——	——	——	——	——	——	——	——	——
108	0.5	——	3.1	1.2	0.1	0.4	4.8	28.2	21.8	33.0	22	14
52	1.8	——	4.9	1.0	0.2	0.4	6.5	45.3	27.1	51.8	24	12
20	2.4	——	2.9	0.7	0.1	0.3	4.0	39.2	17.7	43.2	22	9
15	1.6	——	1.4	0.5	0.1	0.2	2.2	25.0	11.8	27.2	19	8
——	0.8	——	1.0	0.5	0.1	0.2	1.8	9.8	8.0	11.6	22	16
——	——	——	——	——	——	——	——	——	——	——	——	——
——	——	——	——	——	——	——	——	——	——	——	——	——

TABLE 3.—*Physical and chemical*

Pedon number[1]	Depth	Horizon	Particle-size distribution				Moisture tension		pH 1:1 H_2O	Organic carbon	Nitrogen
			Sand (2–.05 mm)	Silt (.05–.002 mm)	Clay (less than .002 mm)	Gravel (2–76 mm)	⅓ bar	15 bar			
	Cm		*Pct*	*Pct*	*Pct*	*Pct*	*Pct*	*Pct*		*Pct*	*Pct*
92[2,3]	6–5	O11	—	—	—	—	—	—	4.1	44+	0.417
	5–0	O12	—	—	—	—	—	—	4.0	19+	0.149
	0–4	A2	38.8	55.2	6.0	—	—	11.0	4.2	8.07	0.126
	4–5	B21	39.9	51.7	8.4	Tr.	—	15.1	4.5	6.24	0.268
	5–9	B22	36.2	54.0	9.8	Tr.	—	13.1	5.2	2.98	0.138
	9–15	B23	37.2	53.4	9.4	Tr.	—	10.5	5.6	1.84	0.088
	15–22	B3	35.4	56.0	8.6	Tr.	—	10.0	5.8	1.38	0.058
	22–35	C1	21.4	71.1	7.5	Tr.	—	7.8	5.9	0.60	—
	35–48	C2	46.0	50.6	3.4	Tr.	—	4.0	5.5	0.31	—
	48–60	C3	45.5	51.4	3.1	Tr.	—	2.8	5.6	0.29	—
	60–80	IIC4	30.5	45.2	24.3	Tr.	—	8.8	5.5	0.19	—
93[2,3]	8–0	O1	—	—	—	—	—	—	4.6	42+	0.419
	0–4	A2	12.4	79.5	8.1	—	—	5.0	4.3	3.37	0.126
	4–9	B21	42.5	50.6	6.9	—	—	18.9	4.7	8.16	0.372
	9–15	B22	32.9	62.3	4.8	—	—	9.2	5.2	2.04	0.122
	15–24	B3	34.5	61.2	4.3	—	—	6.2	5.4	1.19	0.097
	24–30	A2b	42.8	53.9	3.3	—	—	4.5	5.4	0.97	0.068
	30–40	B21b	24.8	70.5	4.7	—	—	8.8	5.4	1.29	0.092
	40–50	B22b	20.5	74.7	4.8	—	—	8.0	5.5	1.15	0.097
	50–65	B3b	22.0	74.7	3.3	—	—	5.4	5.4	0.83	0.074
	65–88	C1b	36.0	61.7	2.3	—	—	3.0	5.4	0.43	—
	88–108	IIC2	80.0	18.4	1.6	—	—	1.2	5.2	0.19	—
95[2]	0–8	A2	21.2	74.5	4.3	—	—	13.8	4.1	13.+	.327
	8–18	B2	18.1	68.4	3.5	—	—	9.0	5.2	2.64	.111
	18–25	B3	24.6	70.4	5.0	Tr.	—	8.5	5.3	1.99	.086
	25–60	IIC	25.3	70.8	3.9	46	—	9.4	5.4	1.86	.076
99[2,3]	10–0	O1, O2	—	—	—	—	—	111.	4.0	47.58	1.180
	0–10	A21	30.8	60.7	8.5	26	90.1	22.4	4.7	8.80	1.409
	10–18	A22	—	—	—	40	61.7	8.3	5.0	2.80	0.153
	18–20	B21h	69.4	19.6	11.0	53	102.	27.7	4.6	11.87	0.477
	20–28	B22ir	—	—	—	56	104.	32.5	4.8	14.00	0.510
	28–43	B23ir	—	—	—	71	123.	24.8	4.6	10.60	0.411
	43–51	B3	73.1	17.9	9.0	50	59.8	15.0	4.7	4.85	0.156
	51–81	C	69.0	25.3	5.7	60	28.0	10.7	5.1	1.75	0.074
100[2,3]	0–2	A2	42.2	31.5	26.3	16	—	20.0	4.6	6.79	0.238
	2–9	B21h	27.5	49.7	22.8	10	—	59.9	4.9	16.5	0.798
	9–15	B22ir	32.6	44.7	22.7	23	—	54.2	4.5	8.27	0.376
	15–30	B3	39.4	44.4	16.2	27	—	55.5	4.6	6.66	0.296
	30–48	C1	35.1	47.5	17.4	30	—	37.1	5.7	3.44	0.175
	48–60	C2	35.7	45.9	18.4	40	—	37.8	6.3	3.14	0.170
	60–80	C3	38.8	41.5	19.7	40	—	37.4	6.9	2.70	0.182
	80–98	C4	34.8	35.6	29.6	30	—	19.9	7.0	0.70	0.065
101[2,3]	13–0	O1	—	—	—	—	—	22.1	4.7	45.40	1.356
	0–4	A2	20.9	65.6	13.5	—	84.6	24.4	4.5	9.25	0.444
	4–10	B21h	26.1	63.1	10.8	—	69.1	24.6	4.4	10.01	0.530
	10–18	B22h	—	—	—	—	65.8	22.1	4.4	8.13	0.382
	18–28	B31	13.3	82.0	4.7	—	23.5	9.2	5.0	1.63	0.098
	28–66	B32	—	—	—	—	30.2	8.9	5.0	1.64	0.102
	66–91	C	8.3	88.5	3.2	—	19.0	3.8	5.6	0.45	0.042
104	0–4	A2	16.2	75.8	8.0	—	—	—	4.6	3.18	—
	4–6	B21	26.8	56.3	16.9	—	—	—	4.8	2.90	—
	6–12	B22	52.4	32.0	15.6	52	—	—	5.0	2.13	—
	12+	C	70.8	22.2	7.0	54	—	—	5.3	0.57	—

[1] Pedons are numbered and described in the section "Soil orders and subgroups in Alaska."
[2] Because of incomplete dispersion of thixotropic material, particle-size distribution is only approximate.
[3] pH in saturated paste.
[4] Lower 3 cm of B22g horizon is 12.7% organic carbon.

analyses of selected pedons—Continued

C/N ratio	Extractable Fe	Extractable Al	Extractable cations (milliequivalents per 100 grams of soil)					Extractable acidity	Cation exchange capacity		Base saturation	
			Ca	Mg	Na	K	Sum		NH_4 OAc	Sum	NH_4 OAc	Sum
	Pct	*Pct*						*Meq/100 gm*	*Meq/100 gm*	*Meq/100 gm*	*Pct*	*Pct*
106	——	——	——	——	——	——	——	——	——	——	——	——
128	——	——	——	——	——	——	——	——	——	——	——	——
64	0.5	——	1.8	1.0	0.1	0.3	3.2	22.9	20.7	26.1	15	12
23	2.3	——	2.4	0.8	0.1	0.2	3.5	46.0	28.8	49.5	12	7
22	2.0	——	2.2	1.0	0.1	0.1	3.4	30.3	15.8	33.7	22	10
21	1.9	——	1.2	0.6	0.1	0.1	2.0	18.0	9.6	20.0	21	10
24	1.7	——	1.0	0.4	0.1	0.1	1.6	14.2	7.5	15.8	21	10
——	1.2	——	1.5	0.4	0.1	0.2	2.2	10.8	7.1	13.0	31	17
——	0.6	——	0.8	0.3	<0.1	0.2	1.3	7.4	5.3	8.7	24	15
——	0.5	——	0.8	0.2	<0.1	0.2	1.2	6.0	4.2	7.2	28	17
——	0.8	——	6.7	2.6	0.1	0.3	9.7	5.1	11.5	14.8	84	66
100	——	——	——	——	——	——	——	——	——	——	——	——
27	0.3	——	1.2	0.2	0.1	0.1	1.6	12.2	10.5	13.8	15	12
22	2.9	——	1.3	0.4	0.1	0.1	1.9	65.6	31.5	67.5	6	3
17	1.5	——	0.6	0.2	0.1	0.1	1.0	26.0	9.3	27.0	11	4
12	1.0	——	0.3	<0.1	0.1	<0.1	0.4	15.2	5.2	15.6	8	2
14	0.9	——	0.2	0.1	0.1	<0.1	0.4	11.6	3.7	12.0	11	3
14	1.8	——	1.1	0.1	0.1	<0.1	1.3	21.2	9.3	22.5	14	6
12	1.4	——	1.2	0.3	0.1	<0.1	1.6	19.0	8.2	20.6	20	8
11	1.0	——	1.1	0.2	0.1	<0.1	1.4	13.2	6.4	14.6	22	10
——	0.7	——	0.8	0.2	0.1	<0.1	1.1	1.2	3.7	2.3	30	48
——	0.3	——	0.3	0.3	<0.1	<0.1	0.6	2.5	1.8	3.1	33	19
40	0.7	——	4.2	1.3	0.1	0.3	5.9	25.7	30.7	31.6	19	19
24	2.1	——	1.9	0.2	——	0.4	2.5	17.7	13.3	20.2	19	12
23	1.7	——	1.8	0.2	0.1	0.3	2.4	14.9	11.0	17.3	22	14
24	2.2	——	1.8	0.6	0.2	0.2	2.8	17.8	12.9	20.6	22	14
40	0.4	0.3	19.7	3.7	0.8	2.8	27.0	90.4	106.5	117.4	25	23
22	1.5	0.7	5.0	0.7	0.2	0.2	6.1	54.7	43.8	46.2	14	13
18	0.8	——	2.2	0.3	0.1	0.1	2.7	24.1	18.7	26.8	14	10
25	3.9	1.7	8.5	1.5	0.2	0.1	10.3	87.9	72.4	98.2	14	10
27	3.7	2.5	6.0	1.0	0.2	0.1	7.3	110.6	82.6	117.9	9	6
26	3.6	——	2.4	0.6	0.1	0.1	3.2	100.2	70.5	103.4	5	3
31	2.5	1.8	1.2	0.2	Tr.	Tr.	1.4	61.3	35.9	62.7	4	2
24	1.1	——	0.9	0.1	Tr.	Tr.	1.0	23.9	14.4	24.9	7	4
28	1.9	——	4.4	1.5	0.4	0.2	6.5	31.7	23.9	38.2	27	17
21	6.3	——	40.7	2.8	0.6	0.4	44.5	88.4	62.0	132.9	72	33
22	5.5	——	3.8	0.6	0.3	0.2	4.9	82.0	31.0	86.9	16	6
22	4.9	——	0.8	0.7	0.2	0.1	1.8	74.5	23.6	76.3	8	2
20	4.7	——	5.0	0.7	0.2	0.1	6.0	33.4	15.6	39.4	38	15
18	5.6	——	7.4	0.9	0.3	0.2	8.8	27.9	14.1	36.7	62	24
15	5.0	——	10.9	1.7	0.3	0.1	13.0	19.4	12.9	32.4	101	40
11	3.8	——	8.7	1.4	0.3	0.1	10.5	7.6	10.3	18.1	102	58
33	0.4	0.5	9.3	3.5	0.8	2.5	16.1	112.6	111.5	128.7	14	13
21	0.8	0.2	1.3	0.9	0.2	0.7	3.1	32.1	27.0	35.2	11	9
19	2.4	1.5	0.2	0.3	0.2	0.6	1.3	79.7	51.4	81.0	3	2
21	2.2	——	0.1	0.1	0.1	0.2	0.5	70.6	42.4	71.1	1	1
17	1.3	——	0.2	0.1	0.1	0.2	0.6	24.3	14.1	24.9	4	2
16	1.5	1.2	0.2	0.1	0.1	0.1	0.5	23.9	14.2	24.4	4	2
11	0.6	——	0.2	0.1	0.2	0.1	0.6	10.5	6.4	11.1	9	5
——	1.0	——	5.7	1.4	0.1	0.3	7.5	20.6	——	28.1	——	27
——	3.2	——	5.6	1.6	0.1	0.5	7.8	25.6	——	33.4	——	23
——	1.1	——	3.0	0.9	0.1	0.5	4.5	20.1	——	24.6	——	18
——	.5	——	1.2	0.4	0.1	0.2	1.9	8.6	——	10.4	——	18

[5] pH in 1:5 water solution.
[6] 5 to 20 percent iron-manganese modules.
[7] pH in calcium chloride.

TABLE 4.—*Estimated acreage of map unit*

[Acreages listed represent

Map unit component	Major land resource areas—[1]			
	168	169	170	171
Typic Cryaquents, clayey, nearly level	—	17	3	7
Typic Cryaquents, loamy, nearly level	251	98	153	—
Typic Cryaquents, sandy, nearly level	39	130	341	—
Typic Cryaquents, very gravelly, nearly level to rolling	—	158	58	—
Typic Cryaquents, very gravelly, hilly to steep	—	73	—	—
Andaqueptic Cryaquents, loamy, nearly level	—	—	1	30
Typic Cryofluvents, loamy, nearly level to rolling	5	26	199	—
Typic Cryofluvents, very gravelly, nearly level	11	134	—	—
Typic Cryorthents, clayey, nearly level to rolling	—	—	—	—
Typic Cryorthents, loamy, nearly level to rolling	—	9	92	—
Typic Cryorthents, loamy, hilly to steep	—	—	—	—
Typic Cryorthents, very gravelly, nearly level to rolling	3	33	58	—
Typic Cryorthents, very gravelly, hilly to steep	29	308	35	—
Andeptic Cryorthents, very gravelly, nearly level to rolling	—	—	1	13
Aquic Cryorthents, very gravelly, hilly to steep	—	—	—	—
Lithic Cryorthents, very gravelly, hilly to steep	—	—	—	—
Pergelic Cryorthents, clayey, nearly level to rolling	—	—	—	—
Pergelic Cryorthents, loamy, nearly level to rolling	—	—	—	—
Pergelic Cryorthents, very gravelly, nearly level to rolling	—	—	—	—
Pergelic Cryorthents, very gravelly, hilly to steep	—	23	1	1
Typic Cryopsamments, sandy, nearly level to rolling	—	—	4	—
Typic Cryopsamments, sandy, hilly to steep	—	4	—	30
Pergelic Cryopsamments, sandy, nearly level to rolling	—	—	—	—
Pergelic Cryopsamments, sandy, hilly to steep	—	—	—	—
Sphagnic Borofibrists, nearly level to rolling	—	38	1,463	—
Terric Borofibrists, nearly level	—	—	49	—
Fluvaquentic Cryofibrists, nearly level	253	1	5	1,085
Pergelic Cryofibrists, nearly level	—	9	—	162
Terric Cryofibrists, nearly level	—	—	—	8
Typic Sphagnofibrists, nearly level to rolling	528	141	—	—
Terric Sphagnofibrists, nearly level	22	149	—	—
Typic Cryofolists, hilly to steep	—	29	—	—
Lithic Cryofolists, hilly to steep	991	88	—	30
Typic Borohemists, nearly level	—	26	10	—
Fluvaquentic Borohemists, nearly level	—	—	221	9
Terric Borohemists, nearly level	—	1	164	—
Typic Cryohemists, nearly level to steep	1,020	256	—	—
Lithic Cryohemists, hilly to steep	526	11	—	—
Pergelic Cryohemists, nearly level	—	—	—	—
Terric Cryohemists, nearly level to steep	—	371	—	—
Terric Borosaprists, nearly level	—	—	48	—
Lithic Cryosaprists, hilly to steep	511	4	—	—
Terric Cryosaprists, nearly level to steep	1,014	390	—	—
Typic Cryandepts, loamy, nearly level to rolling	—	—	38	169
Typic Cryandepts, loamy, hilly to steep	—	—	—	1,463
Typic Cryandepts, sandy, nearly level to rolling	—	—	—	452
Typic Cryandepts, sandy, hilly to steep	—	—	—	286
Typic Cryandepts, very gravelly, nearly level to rolling	—	—	—	599
Typic Cryandepts, very gravelly, hilly to steep	—	—	125	3,780
Dystric Cryandepts, loamy, nearly level to rolling	—	—	49	695
Dystric Cryandepts, loamy, hilly to steep	—	—	420	2,330
Dystric Lithic Cryandepts, loamy, hilly to steep	—	—	2	1,125
Dystric Lithic Cryandepts, very gravelly, hilly to steep	—	—	—	18
Lithic Cryandepts, very gravelly, hilly to steep	—	—	16	310
Typic Cryaquepts, loamy, nearly level to rolling	—	1	139	5
Typic Cryaquepts, very gravelly, nearly level to rolling	—	26	10	—
Typic Cryaquepts, very gravelly, hilly to steep	—	91	—	—
Aeric Cryaquepts, loamy, nearly level to rolling	—	—	—	—
Aeric Cryaquepts, very gravelly, nearly level to rolling	—	—	—	—
Aeric Humic Cryaquepts, loamy, nearly level to rolling	—	—	48	—
Andic Cryaquepts, loamy, nearly level to rolling	—	—	1	60
Histic Cryaquepts, loamy, nearly level to rolling	—	1	74	—
Histic Cryaquepts, very gravelly, nearly level to rolling	—	1	34	—
Histic Pergelic Cryaquepts, clayey, nearly level to rolling	—	—	—	—
Histic Pergelic Cryaquepts, loamy, nearly level to rolling	—	1	—	—
Histic Pergelic Cryaquepts, loamy, hilly to steep	—	—	—	—
Histic Pergelic Cryaquepts, sandy, nearly level to rolling	—	—	—	184
Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling	—	2	1	42
Histic Pergelic Cryaquepts, very gravelly, hilly to steep	—	434	—	117

components in major land resource areas

thousands of acres]

Major land resource areas—[1] Continued											Total
172	173	174	175	176	177	178	179	180	181	182	
—	—	—	—	—	—	24	—	—	—	—	51
—	—	—	99	—	1	25	—	—	—	—	627
58	—	—	35	—	—	13	—	—	—	—	616
—	—	—	—	—	—	—	—	—	—	—	216
—	—	—	—	—	—	—	—	—	—	—	73
—	—	—	1	—	—	—	—	—	—	—	32
48	47	3,321	423	538	37	418	—	9	41	—	5,112
—	—	—	35	—	—	—	—	—	—	—	180
14	—	—	—	—	—	—	—	—	—	—	14
25	2	639	90	528	11	—	—	1	—	—	1,397
—	3	4	47	139	21	—	—	—	—	—	214
108	12	372	119	52	—	45	—	—	6	—	808
—	14	1	32	250	—	—	—	—	—	—	669
—	—	—	1	—	—	—	—	—	—	—	15
—	67	3	153	1,238	—	—	—	—	—	—	1,461
—	85	1	823	294	481	4	24	1,257	635	—	3,604
—	—	—	—	—	—	—	—	6	312	—	318
—	—	—	—	79	—	—	—	49	—	—	128
—	—	—	—	39	701	16	—	33	269	472	1,530
234	542	14	290	2,077	1,295	—	—	744	999	117	6,337
2	4	93	—	—	—	—	—	—	—	—	103
29	—	196	71	86	30	89	—	—	—	—	535
—	—	—	—	28	—	—	—	1	16	914	959
—	—	—	—	5	93	2	23	—	18	—	141
5	38	—	24	—	—	8	—	—	—	—	1,576
—	—	—	—	—	—	—	—	—	—	—	49
8	—	—	7	—	—	1,149	—	—	—	—	2,508
547	50	4,539	2,150	1,545	937	4,866	290	223	632	1,438	17,388
—	—	—	—	—	—	24	—	—	—	—	32
—	—	—	—	—	—	—	—	—	—	—	669
—	—	—	—	—	—	—	—	—	—	—	171
—	—	—	—	—	—	—	—	—	—	—	29
—	—	—	—	—	—	—	—	—	—	—	1,109
6	—	—	—	—	—	—	—	—	—	—	42
—	—	—	—	—	—	—	—	—	—	—	230
—	—	—	—	—	—	—	—	—	—	—	165
—	—	—	—	—	—	—	—	—	—	—	1,276
—	—	—	—	—	—	—	—	—	—	—	537
2	3	44	—	8	—	—	—	—	—	—	57
—	—	—	—	—	—	—	—	—	—	—	371
—	—	—	—	—	—	—	—	—	—	—	48
—	—	—	—	—	—	—	—	—	—	—	515
—	—	—	—	—	—	—	—	—	—	—	1,404
—	—	—	—	—	—	172	—	—	—	—	379
—	—	—	—	—	14	2	8	—	—	—	1,487
—	—	—	—	—	—	1,106	—	—	—	—	1,558
—	—	—	—	—	—	—	—	—	—	—	286
—	—	—	501	—	—	372	—	—	—	—	1,472
—	67	—	497	—	—	23	50	—	—	—	4,542
—	—	—	825	—	—	—	—	—	—	—	1,569
—	—	—	83	—	—	—	—	—	—	—	2,833
—	—	—	20	—	—	—	—	—	—	—	1,147
—	—	—	10	—	—	—	—	—	—	—	28
—	9	—	53	—	—	19	6	—	—	—	413
—	—	—	—	—	—	—	—	—	—	—	145
6	—	—	—	—	—	—	—	—	—	—	42
—	—	—	—	—	—	—	—	—	—	—	91
19	42	1,251	960	1,845	119	—	—	1	—	—	4,237
—	1	11	11	—	—	—	—	—	—	—	23
—	—	—	—	—	—	—	—	—	—	—	48
—	—	—	2	—	—	—	—	—	—	—	63
—	—	—	6	—	—	2	—	—	—	—	83
—	—	—	—	—	—	—	—	—	—	—	35
1,091	—	—	—	—	—	—	—	—	—	—	1,091
1,554	334	12,846	10,487	14,154	5,955	8,287	541	779	13,440	3,803	72,181
—	—	2	757	254	196	—	—	—	—	—	1,209
—	—	73	—	60	36	501	—	—	—	—	854
638	107	772	1,133	279	586	54	873	135	50	—	4,672
342	302	81	3,466	4,391	3,801	46	148	410	403	—	13,941

TABLE 4.—*Estimated acreage of map unit*

Map unit component	Major land resource areas—[1]			
	168	169	170	171
Humic Cryaquepts, loamy, nearly level to rolling	—	—	90	—
Lithic Cryaquepts, very gravelly, hilly to steep	15	—	—	—
Pergelic Cryaquepts, loamy, nearly level to rolling	—	—	—	—
Pergelic Cryaquepts, loamy, hilly to steep	—	—	—	—
Pergelic Cryaquepts, sandy, nearly level to rolling	—	—	—	—
Pergelic Cryaquepts, very gravelly, nearly level to rolling	—	1	—	5
Pergelic Cryaquepts, very gravelly, hilly to steep	—	160	24	—
Pergelic Ruptic-Histic Cryaquepts, clayey, nearly level to rolling	—	—	—	—
Pergelic Ruptic-Histic Cryaquepts, loamy, nearly level to rolling	—	—	—	—
Pergelic Ruptic-Histic Cryaquepts, very gravelly, nearly level to rolling	—	—	—	—
Pergelic Ruptic-Histic Cryaquepts, very gravelly, hilly to steep	—	—	—	—
Typic Cryochrepts, loamy, nearly level to rolling	—	8	—	—
Typic Cryochrepts, loamy, hilly to steep	—	—	—	—
Typic Cryochrepts, sandy, nearly level to rolling	—	—	—	—
Typic Cryochrepts, sandy, hilly to steep	—	—	—	—
Typic Cryochrepts, very gravelly, nearly level to rolling	—	6	—	—
Typic Cryochrepts, very gravelly, hilly to steep	—	209	—	—
Alfic Cryochrepts, loamy, nearly level to rolling	—	—	—	—
Alfic Cryochrepts, loamy, hilly to steep	—	—	—	—
Alfic Cryochrepts, very gravelly, hilly to steep	—	—	—	—
Andic Cryochrepts, very gravelly, hilly to steep	—	—	—	—
Dystric Cryochrepts, very gravelly, hilly to steep	—	—	—	—
Lithic Cryochrepts, very gravelly, hilly to steep	—	16	—	—
Pergelic Cryochrepts, very gravelly, hilly to steep	—	189	—	—
Typic Cryumbrepts, very gravelly, hilly to steep	—	—	—	—
Entic Cryumbrepts, loamy, nearly level to rolling	—	—	—	—
Entic Cryumbrepts, very gravelly, hilly to steep	—	60	—	—
Lithic Cryumbrepts, very gravelly, hilly to steep	—	121	12	—
Lithic Ruptic-Entic Cryumbrepts, very gravelly, hilly to steep	—	98	—	—
Pergelic Cryumbrepts, very gravelly, nearly level to rolling	—	—	—	2
Pergelic Cryumbrepts, very gravelly, hilly to steep	—	1,066	—	—
Pergelic Cryaquolls, loamy, nearly level to rolling	—	—	—	—
Pergelic Cryaquolls, very gravelly, nearly level to rolling	—	—	—	—
Pergelic Cryaquolls, very gravelly, hilly to steep	—	—	—	—
Typic Cryoborolls, loamy, nearly level to rolling	—	—	—	—
Lithic Ruptic-Entic Cryoborolls, very gravelly, hilly to steep	—	—	—	—
Pergelic Cryoborolls, very gravelly, nearly level to rolling	—	—	—	—
Pergelic Cryoborolls, very gravelly, hilly to steep	—	—	—	—
Typic Cryaquods, sandy, nearly level	—	—	49	—
Lithic Cryaquods, very gravelly, hilly to steep	248	2	—	—
Pergelic Sideric Cryaquods, loamy, nearly level to rolling	—	—	—	—
Sideric Cryaquods, loamy, nearly level to rolling	—	—	61	—
Sideric Cryaquods, sandy, nearly level to rolling	—	—	7	—
Sideric Cryaquods, very gravelly, nearly level to rolling	—	1	60	—
Cryic Fragiaquods, very gravelly, nearly level to rolling	—	7	—	—
Cryic Fragiaquods, very gravelly, hilly to steep	496	303	—	—
Placic Haplaquods, loamy, nearly level to rolling	15	—	—	—
Typic Cryohumods, loamy, hilly to steep	61	—	—	—
Lithic Cryohumods, loamy, hilly to steep	5	—	—	—
Lithic Cryohumods, very gravelly, hilly to steep	—	—	1	—
Cryic Placohumods, loamy, hilly to steep	30	—	—	—
Typic Cryorthods, loamy, nearly level to rolling	—	2	1,001	—
Typic Cryorthods, loamy, hilly to steep	—	65	439	7
Typic Cryorthods, sandy, nearly level to rolling	—	—	—	—
Typic Cryorthods, sandy, hilly to steep	11	156	—	—
Typic Cryorthods, very gravelly, nearly level to rolling	—	110	489	—
Typic Cryorthods, very gravelly, hilly to steep	5	368	474	—
Entic Cryorthods, sandy, nearly level to rolling	—	—	25	—
Entic Cryorthods, sandy, hilly to steep	—	—	24	—
Humic Cryorthods, loamy, nearly level to rolling	—	—	—	—
Humic Cryorthods, loamy, hilly to steep	—	—	239	—
Humic Cryorthods, very gravelly, nearly level to rolling	263	2	—	—
Humic Cryorthods, very gravelly, hilly to steep	1,532	1,421	322	102
Humic Lithic Cryorthods, very gravelly, hilly to steep	1,487	105	—	—
Lithic Cryorthods, loamy, hilly to steep	—	—	—	—
Lithic Cryorthods, very gravelly, hilly to steep	—	—	1	—
Pergelic Cryorthods, sandy, nearly level to rolling	—	—	—	—
Pergelic Cryorthods, very gravelly, nearly level to rolling	—	—	—	6
Pergelic Cryorthods, very gravelly, hilly to steep	—	218	39	2
Cryic Fragiorthods, very gravelly, hilly to steep	992	8	—	—

components in major land resource areas—Continued

Major land resource areas—[1] Continued											Total
172	173	174	175	176	177	178	179	180	181	182	
—	—	—	—	—	—	—	—	—	—	—	90
—	—	—	—	26	27	—	—	135	7	—	210
35	4	1,354	87	97	54	603	18	40	1,827	1,165	5,284
—	14	1	32	250	—	—	—	—	—	—	297
—	—	—	—	75	—	—	—	7	134	1,174	1,390
27	17	10	1,505	328	1,879	31	—	80	1,498	908	6,289
183	1,235	13	2,599	6,016	2,746	13	59	1,624	2,470	—	17,142
—	—	—	—	—	—	—	—	—	52	15	67
—	—	—	77	—	155	—	—	—	195	829	1,256
—	—	—	—	39	1,070	16	—	—	732	—	1,857
—	—	—	—	51	322	—	—	128	117	—	618
147	6	3,471	563	1,113	—	—	—	—	—	—	5,308
—	23	25	813	2,453	198	—	—	3	—	—	3,515
—	—	107	19	70	42	—	—	—	—	—	238
—	—	33	29	—	—	—	—	—	—	—	62
128	29	548	—	44	—	—	—	—	—	—	755
313	358	118	1,231	6,032	776	—	—	50	29	—	9,116
—	—	—	—	216	—	—	—	—	—	—	216
—	—	—	—	647	—	—	—	—	—	—	647
—	—	—	—	324	—	—	—	—	—	—	324
—	14	—	32	250	—	—	—	—	—	—	296
—	14	—	32	250	—	—	—	—	—	—	296
20	10	15	205	454	200	—	—	143	7	—	1,070
142	839	15	252	3,349	386	5	14	41	364	—	5,596
—	—	—	93	65	1,056	13	25	1	17	—	1,270
67	—	—	—	—	—	—	—	—	—	—	67
—	—	—	43	—	—	—	—	—	—	—	103
66	62	—	149	—	—	—	—	—	—	—	410
19	7	—	508	49	924	13	34	32	46	—	1,730
46	11	37	531	—	—	—	—	—	—	—	627
832	196	5	2,642	778	4,098	41	165	522	538	102	10,985
—	—	—	10	37	37	—	17	103	2,218	1,311	3,733
—	—	—	—	5	93	2	—	1,162	296	—	1,558
—	—	—	—	—	—	—	35	139	980	—	1,154
40	—	—	—	296	—	—	—	—	—	—	336
—	—	—	—	12	55	—	—	32	29	—	128
—	—	—	—	5	135	7	26	—	18	—	191
—	—	—	10	40	269	9	136	918	2,355	—	3,737
—	—	—	—	—	—	—	—	—	—	—	49
—	—	—	—	—	—	—	—	—	—	—	250
—	—	—	—	—	40	243	17	—	2	—	302
—	—	2	19	—	—	—	—	—	—	—	82
—	—	—	—	—	—	—	—	—	—	—	7
—	—	—	—	—	—	—	—	—	—	—	61
—	—	—	—	—	—	—	—	—	—	—	7
—	—	—	—	—	—	—	—	—	—	—	799
—	—	—	—	—	—	—	—	—	—	—	15
—	—	—	—	—	—	—	—	—	—	—	61
—	—	—	—	—	—	—	—	—	—	—	5
—	4	—	5	—	—	—	—	—	—	—	10
—	—	—	—	—	—	—	—	—	—	—	30
—	—	15	578	—	27	2	—	—	—	—	1,625
—	39	—	1,777	481	187	—	—	1	—	—	2,996
—	—	144	50	5	3	—	—	—	—	—	202
—	—	34	12	—	—	—	—	—	—	—	213
—	17	108	391	—	18	—	—	—	—	—	1,133
45	37	53	1,662	—	77	—	—	—	—	—	2,721
—	—	—	—	—	—	2	—	—	—	—	27
—	—	—	—	—	—	—	—	—	—	—	24
—	—	—	539	—	—	28	—	—	—	—	567
—	180	—	—	—	—	—	—	—	—	—	419
—	—	—	—	—	—	—	—	—	—	—	265
155	250	—	1,502	—	—	9	—	—	—	—	5,293
—	—	—	—	—	—	—	—	—	—	—	1,592
—	—	—	106	—	—	—	—	—	—	—	106
11	6	9	207	27	44	—	—	136	7	—	448
—	—	—	—	85	—	—	—	—	—	—	85
237	38	128	48	—	—	—	—	—	—	—	457
1,408	605	47	1,972	563	300	3	14	137	12	—	5,320
—	—	—	—	—	—	—	—	—	—	—	1,000

TABLE 4.—*Estimated acreage of map unit*

Map unit component	Major land resource areas—[1]			
	168	169	170	171
Cinder land	—	—	—	455
Dune land	1	16	—	—
Gravelly beaches	1	16	—	—
Lava flows	—	—	—	14
Riverwash	1	21	12	224
Rough mountainous land	8,376	22,201	99	8,826
Rubble land	—	—	—	—
Tidal flats	1	3	2	—
Total	18,743	30,043	7,333	22,653

[1] *Major Land Resource Areas*

Southern Alaska
168 Southeastern Alaska
169 South Central Alaska Mountains
170 Cook Inlet-Susitna Lowland
171 Alaska Peninsula and Southwestern Islands

Interior Alaska
172 Copper River Plateau
173 Alaska Range
174 Interior Alaska Lowlands

5/1) fine sandy loam; common medium distinct mottles of olive brown (2.5Y 4/4); weak thin platy structure; very friable; few roots; thin layer of gravelly silt loam and fragments of red shale; medium acid; abrupt smooth boundary.

C5—27 to 42 inches (68–105 cm); gray (5Y 5/1) silty clay loam; common coarse prominent mottles of yellowish brown (10YR 5/6) and dark red (2.5YR 3/6); massive; firm; dark red partly decomposed fragments of shale; few fine pores and vesicles; underlying material is layered fine sandy loam, silt loam, and shaly silt loam; medium acid.

In areas along the coasts and near the mouths of large rivers, the soils consist of silty and clayey tidal sediment with buried lenses of peat. The vegetation on these soils is sedges and other plants of coastal marshes.

Pedon *4*, Typic Cryaquents, clayey (unnamed series). Bordering Knik Arm of Cook Inlet (*34*).

O1—0 to 6 inches (0–15 cm); gray (2.5Y 5/1) sedge peat impregnated with bluish silt.

C1—6 to 12 inches (15–30 cm); bluish gray (5B 5/1) silt, organic matter, and a mass of roots; very wet.

C2—12+ inches (30+ cm); interbedded layers of bluish silt loam and a few seams of reed and sedge peat saturated with salt water; few roots; many feet thick.

Andaqueptic Cryaquents differ from Typic Cryaquents in that they formed, at least in part, in volcanic ash material. They occur primarily in the Alaska Peninsula and Southwestern Islands Land Resource Area.

Pedon *5*, Andaqueptic Cryaquents, loamy (Kizhuyak series). Head of Middle Bay, Kodiak Island (*54*).

O1—1 inch to 0 (2–0 cm); dark brown (7.5YR 3/2) mat of roots and straw; few mycelia; very strongly acid; abrupt smooth boundary.

C1—0 to 4 inches (0–10 cm); pale brown (10YR 6/3) loamy fine sand mottled with yellowish red; single grain; loose; few roots; strongly acid; abrupt wavy boundary.

C2—4 to 27 inches (10–68 cm); alternating layers, usually less than 1 inch thick, of grayish brown (10YR 5/2) coarse silt loam and light gray (10YR 7/2) loamy fine sand; thin streaks of yellowish red along the few root channels; a few thin layers of organic material; the silt loam layers are massive and firm, and the loamy fine sand layers are single grain and loose; strongly acid; abrupt wavy boundary.

C3—27 to 40 inches (68–100 cm); light yellowish brown (10YR 6/4) coarse silt loam with a few streaks of light gray; massive; firm; no roots; strongly acid.

Fluvents

Fluvents formed in recently deposited sediment. The water table is normally deep in these soils, but most are subject to periodic flooding. Nearly all are texturally stratified and either contain lenses of organic material or are moderately high in organic matter to a great depth. Soils that consist entirely of sand and those with mean annual temperatures below freezing are excluded from this suborder. Most Fluvents in Alaska support forests similar to those of the adjoining uplands but with a large proportion of cottonwood and willows.

Typic Cryofluvents in Alaska consist mostly of soils with alternating layers of sand and silt loam. Many are underlain by a thick deposit of water worked very gravelly sand. Most of the soils have gray colors throughout, but many have irregular black and brown streaks caused by burial of organic matter under fresh deposits, by frost heaving, and by uneven oxidation of the soil material.

These soils occupy natural levees along nearly all major rivers and many of the smaller streams in all parts of Alaska except in the Arctic and in the southwestern part of the State where the dominant soil material is volcanic ash. Areas that consist dominantly of natural levees range in width from less than 100 feet (30 m) to several miles.

In southeastern and south central Alaska, where precipitation is moderate or high, most Typic Cryofluvents are acid. The well drained soils of adjacent uplands are dominantly Cryorthods.

Pedon *6*, Typic Cryofluvents, loamy (Susitna series). About 4 miles (6 km) west of Caswell (*59*).

O1—2 inches to 0 (5–0 cm); dark brown (10YR 2/2) partly decomposed organic matter; many roots; very strongly acid; clear smooth boundary.

A1—0 to 3 inches (0–8 cm); very dark gray (10YR 3/1) fine sandy loam; weak medium granular structure; very friable; many roots; very strongly acid; clear wavy boundary.

C—3 to 45 inches (8–112 cm); dark gray (5Y 4/1) silt loam, fine sand, and very fine sand in sorted stratified layers that range from less than 1 inch to 5 inches in thickness; a

components in major land resource areas—Continued

Major land resource areas—[1] Continued											Total
172	173	174	175	176	177	178	179	180	181	182	
—	—	—	—	—	—	102	—	—	—	—	557
—	—	—	—	33	11	—	—	—	—	59	120
—	—	—	—	—	—	—	—	—	—	—	17
—	—	—	—	—	111	1	8	—	—	—	134
2	—	—	6	—	—	2	—	1	16	16	301
340	13,218	4	3,279	981	1,258	24	92	20,018	439	—	79,155
—	—	—	—	—	16	—	6	58	262	—	342
—	—	—	—	—	—	—	—	—	—	—	6
8,999	18,962	30,559	46,826	53,435	30,930	18,434	2,629	29,159	31,488	12,323	362,516

175 Kuskokwim Highlands
176 Interior Alaska Highlands

Arctic and Western Alaska
177 Norton Sound Highlands
178 Western Alaska Coastal Plains and Deltas
179 Bering Sea Islands
180 Brooks Range
181 Arctic Foothills
182 Arctic Coastal Plain

few isolated patches of very dark brown (10YR 3/2), buried organic material; massive; very friable; a few roots to a depth of 30 inches; strongly acid.

In interior Alaska, Typic Cryofluvents occur in close association with Pergelic Cryaquepts that have a perennially frozen substratum. These soils, however, either are free of permafrost or are perennially frozen only at great depth. Those well drained soils of flood plains that have a mean annual soil temperature below freezing and that may therefore be assumed to have a perennially frozen layer at some depth, are properly classified as Pergelic Cryorthents. It was not possible to identify such soils consistently in mapping, however, and they are included with the Typic Cryofluvents in this survey. Well drained upland soils in interior Alaska are mostly Cryochrepts.

Pedon *7*, Typic Cryofluvents, very gravelly (Jarvis series). About 3 miles (5 km) north of Harding Lake, Tanana Valley (*58*).

O11—5 to 3 inches (12–8 cm); mat of undecomposed moss, leaves, and twigs.

O12—3 inches to 0 (8–0 cm); dark reddish brown (5Y 2/2) mat of decomposing moss, leaves, and twigs; many fine roots; abrupt smooth boundary.

A1—0 to 2 inches (0–5 cm); very dark grayish brown (10YR 3/2) silt loam that contains streaks of dark brown (10YR 3/3); weak very fine granular structure; very friable; many fine roots; strongly acid; clear wavy boundary.

AC—2 to 7 inches (5–18 cm); dark grayish brown (10YR 4/2) very fine sandy loam that contains streaks of dark yellowish brown (10YR 3/4); weak very thin platy structure; very friable; micaceous; common roots; strongly acid; gradual boundary.

C1—7 to 17 inches (18–42 cm); grayish brown (2.5Y 5/2) very fine sand; a few dark yellowish brown (10YR 4/4) patches; weak thin platy structure; very friable; a few thin lenses of gray (2.5Y 5/1) silt from 1/16 to ½ inch thick; micaceous; a few roots; medium acid; clear smooth boundary.

C2—17 to 26 inches (42–65 cm); olive gray (5Y 5/2) very fine sand; weak thin platy structure; very friable; thin lenses of gray (5Y 5/1) silt make up about 30 percent of mass; micaceous; slightly acid; clear smooth boundary.

IIC3—26 to 40 inches (65–100 cm); very gravelly coarse sand; loose; rounded pebbles; slightly acid.

Many of the Typic Cryofluvents along the Yukon and Kuskokwim Rivers are calcareous at some depth.

Pedon *8*, Typic Cryofluvents, loamy (Takotna series). About 3 miles (5 km) east of McGrath.

O1—2 inches to 0 (5–0 cm); black (5YR 2/1) partially decomposed organic material; many roots; very strongly acid; clear smooth boundary.

A1—0 to 2½ inches (0–6 cm); very dark grayish brown (10YR 3/2) very fine sandy loam; weak very fine granular structure; very friable; common roots; strongly acid; clear smooth boundary.

C1—2½ to 28 inches (6–70 cm); olive gray (5Y 4/2) very fine sand with thin strata of silt loam and fine sand; weak thin platy structure; very friable; common roots to 10 inches; few below; buried woody materials; neutral; gradual boundary.

C2—28 to 42 inches (70–105 cm); same as horizon above but weakly calcareous.

Orthents

Orthents are Entisols with no stratification or irregular distribution of organic matter (except in areas where the mean annual soil temperature is below freezing) and texture finer than loamy fine sand. They do not have the high water table characteristic of the Aquents. They occur in nearly all parts of Alaska, in parent material ranging from recently deposited loess to weathered rock and to alluvium with less than 10 inches (25 cm) of fine material over very gravelly sand. Many have mean annual temperatures below freezing but have no ice-rich permafrost at shallow depths.

Typic Cryorthents are the Orthents that are thicker than 20 inches (50 cm) over bedrock and that have mean annual temperatures above freezing. They have a wide range in texture. Colors are dominantly gray, but in many places uneven oxidation of recently deposited material has resulted in color variegation that resembles mottling like that in poorly drained soils. The incipient development in these soils has not progressed to the point where diagnostic subsurface horizons can be recognized. Most soils in this subgroup support forests typical of the area in which they are located.

Very gravelly Typic Cryorthents occur on parts of outwash plains that no longer are saturated with

glacial outflow water and on low terraces bordering rapidly flowing rivers.

Pedon *9*, Typic Cryorthents, very gravelly (Chena series). About 5 miles (8 km) southeast of Palmer (*57*).

O1—3 inches to 0 (8–0 cm); dark reddish brown (5YR 2/2) mat of moss and decomposing plants; many fine roots; mycelia; abrupt smooth boundary.
A1—0 to 2 inches (0–5 cm); very dark gray (5Y 3/1) silt loam; weak medium granular structure; friable; common fine roots; clear smooth boundary.
C1—2 to 4 inches (5–10 cm); olive gray (5Y 4/2) gravelly silt loam; weak medium subangular blocky structure; friable; common roots; clear smooth boundary.
IIC2—4 to 18 inches (10–45 cm); olive gray (5Y 4/2) sand and gravel; single grain; loose; more than 50 percent of mass consists of rounded stones and cobblestones.

Soils with no color development other than a thin dark horizon at the surface are common on exposed acid glacial till in southeastern Alaska. Soils with similar pedon characteristics also occur in interior Alaska, on steep southerly slopes subject to soil creep.

Pedon *10*, Typic Cryorthents, very gravelly (Olnes series). About 30 miles (48 km) north of Fairbanks (*52*).

O1—½ inch to 0 (1–0 cm); dark reddish brown (5YR 3/2) forest litter; many roots; charcoal fragments; abrupt smooth boundary.
C1—0 to ½ inch (0–1 cm); grayish brown (10YR 5/2) silt loam; weak very thin platy structure; friable; common roots; medium acid; abrupt broken boundary.
C2—½ to 19 inches (1–48 cm); dark grayish brown (2.5Y 4/2) silt loam; weak thin platy parting to weak fine subangular blocky structure; friable; few roots; contains 10 percent schist fragments by volume, with thin coating of silt on upper surface of fragments; medium acid; gradual boundary.
C3—19 to 40 inches (48–100 cm); dark grayish brown (2.5Y 4/2) very gravelly silt loam; weak fine subangular blocky structure; very friable; few to no roots; contains 50 percent schist fragments by volume; medium acid.

The parent material in many Typic Cryorthents is loess blown from the braided beds of rivers that have a heavy silt load. Small increments of loess are added to these soils each year. Fairly intense color variegation is a common feature.

Pedon *11*, Typic Cryorthents, loamy (Bodenburg series). About 1 mile (1.6 km) south of Palmer (*53*).

O11—2 to 1½ inches (5–4 cm); forest litter.
O12—1½ inches to 0 (4–0 cm); mat of roots and partially decomposed organic material; dominant color is very dark brown (10YR 2/2); abrupt smooth boundary.
C1—0 to 3 inches (0–8 cm); gray (5Y 5/1) silt loam, mottled with very dark grayish brown; weak very fine subangular blocky structure; friable; many roots; abrupt smooth boundary.
C2—3 to 8 inches (8–20 cm); mixed very dark grayish brown (10YR 3/2), dark brown (10YR 4/3), and dark gray (5Y 4/1) silt loam, with very dark grayish brown the dominant color; weak medium subangular blocky structure; friable; many roots; clear wavy boundary.
C3—8 to 27 inches (20–68 cm); gray (5Y 5/1) silt loam with mottles and occasional horizontal streaks of dark brown; weak medium subangular blocky structure parting under pressure to thick plates; friable; few roots; clear wavy boundary.
C4—27 to 36 inches (68–90 cm); mixed olive brown (2.5Y 4/4) and gray (5Y 5/1) silt loam, with olive brown the dominant color; massive; friable; very few roots; abrupt smooth boundary.
IIC5—36 to 48 inches (90–120 cm); very gravelly loamy coarse sand.

In hills bordering the Yukon River, which in its upper course drains large areas of limestone bedrock, the loess is commonly calcareous. Some of these forested soils in the upper Yukon Valley and in areas farther north may have mean temperatures below freezing and probably perennially frozen strata at depths of 4 feet (120 cm) or more. Because of the difficulty of identifying such soils consistently in the course of the mapping, they are included with the Typic Cryorthents in this survey. They are properly classified as Pergelic Cryorthents.

Pedon *12*, Typic Cryorthents, loamy (Kandik series). About 5 miles (8 km) west of Circle.

O1—2 inches to 0 (5–0 cm); very dark gray (5YR 3/1) forest litter; fungal mycelia in lower part; many roots; abrupt smooth boundary.
A1—0 to 2 inches (0–5 cm); dark grayish brown (10YR 4/2) silt loam; streaks of grayish brown (2.5Y 5/2); weak fine granular structure; very friable; many roots; charcoal fragments; abrupt wavy boundary.
C1—2 to 11 inches (5–28 cm); dark grayish brown (2.5Y 4/2) silt loam; streaks and patches of grayish brown (5Y 4/2), dark yellowish brown (10YR 4/4), and dark brown (7.5YR 4/4); weak very thin platy structure; very friable; common roots; gradual boundary.
C2—11 to 15 inches (28–38 cm); olive brown (2.5Y 4/4) silt loam; roughly horizontal streaks of dark grayish brown (2.5Y 4/2) and dark yellowish brown (10YR 4/4); moderate very thin platy structure; very friable; few roots; calcareous; gradual boundary.
C3—15 to 24 inches (38–60 cm); olive (5Y 4/3) silt loam; few faint streaks of olive gray (5Y 4/2) and dark gray (5Y 4/1); moderate very thin platy structure; very friable; few roots; calcareous; gradual boundary.
C4—24 to 42 inches (60–105 cm); olive gray (5Y 4/2) silt loam; moderate very thin platy structure; very friable; few to no roots; calcareous.

Typic Cryorthents also occur in glacial lacustrine deposits or in backwater parts of former flood plains. Soils in these positions may be clayey.

Andeptic Cryorthents have a layer of recent volcanic ash over soils that are otherwise like those of the Typic Cryorthents. They are inextensive, and occur mainly in the Alaska Peninsula and Southwestern Islands Major Land Resource Area.

Pedon *13*, Andeptic Cryorthents, very gravelly (Chiniak series). Shore of Kalsin Bay, Kodiak Island (*54*).

O1—2½ inches to 0 (6–0 cm); dark brown (10YR 3/3) mat of roots and partly decayed organic material; sprinkling of grains of volcanic ash; strongly acid; abrupt smooth boundary.
C1—0 to 5 inches (0–12 cm); volcanic ash consisting of light yellowish brown (10YR 6/4) coarse silt loam; massive; firm in place but friable when disturbed; few roots; strongly acid; abrupt wavy boundary.
C2—5 to 7 inches (12–18 cm); volcanic ash consisting of light yellowish brown (10YR 6/4) loamy fine sand; loose in place; few roots; very strongly acid; clear wavy boundary.
C3—7 to 10 inches (18–25 cm); volcanic ash consisting of grayish brown (10YR 5/2) fine sand; single grain; loose; few roots; strongly acid; abrupt wavy boundary.
Ab—10 to 13 inches (25–32 cm); dark reddish brown (5YR 3/3) gravelly loam; weak, fine, granular structure; friable; few roots; very strongly acid; clear wavy boundary.
Cb—13 to 28 inches (32–70 cm); fine gravel, mostly slate fragments; strongly acid.

Aquic Cryorthents are Orthents that have a high water table for relatively short periods during the summer and that have olive brown or brown colors with some mottling near the surface. They are not extensive. The only known occurrence of these soils in

Alaska is on relatively smooth ridges in interior Alaska just above the limits of the white spruce-paper birch-quaking aspen forest. They apparently have no permafrost, but are covered with vegetation normally associated with permafrost—either a black spruce forest or a thick growth of willows, alder, and other shrubs.

Pedon *14*, Aquic Cryorthents, loamy (Fairplay series). About 30 miles (48 km) north of Fairbanks (*52*).

O1—3 inches to 0 (8–0 cm); black (5YR 2/1) partially decomposed organic matter; common roots; abrupt smooth boundary.

C1—0 to 18 inches (0–45 cm); olive brown (2.5Y 4/4) silt loam; many medium and coarse faint mottles of dark yellowish brown (10YR 4/4) and dark grayish brown (2.5Y 4/2); weak fine subangular blocky structure; friable; common roots; very strongly acid; gradual boundary.

C2—18 to 30 inches (45–75 cm); olive brown (2.5Y 4/4) gravelly silt loam; moderate fine subangular structure; friable; few roots; many fine tubular pores; silty coatings on upper surface of pebbles and rock fragments; strongly acid; gradual boundary.

C3—30 to 40 inches (75–100 cm); partially weathered fractured schist; can be removed with a spade.

Lithic Cryorthents are Orthents with bedrock shallower than 20 inches (50 cm). They have been observed on narrow ridges in the Interior Highlands and Kuskokwim Highlands, in the Alaska and Brooks Ranges, and at lower elevations in the Norton Sound Highlands and the Arctic Foothills. Most have mean annual temperatures below freezing, but some are warmer. The vegetation is commonly alpine tundra. Typically, unvegetated patches, stone stripes, and other features associated with frost action are evident in the soil above the bedrock.

Pedon *15*, Lithic Cryorthents, very gravelly (unnamed series). About 5 miles (8 km) northeast of Nome.

O1—3 inches to 0 (8–0 cm); dark reddish brown (5YR 2/2) organic mat in various stages of decay; clear smooth boundary.

A1—0 to 3 inches (0–8 cm); dark brown (10YR 3/3) very flaggy silt loam; weak very fine granular structure; very friable; many roots; very strongly acid; abrupt smooth boundary.

C1—3 to 9 inches (8–22 cm); olive gray (5Y 4/2) very flaggy silt loam, with patches of olive (5Y 4/4 and 5Y 4/3); moderate medium platy structure; friable; common roots; contains streaks less than one inch thick of dark brown (10YR 3/3) decomposed organic matter; very strongly acid; gradual boundary.

C3—9 to 18 inches (22–45 cm); olive (5Y 4/3) very flaggy silt loam; moderate medium platy structure; friable; few roots; very strongly acid; diffuse boundary.

R—18 inches (45 cm); shattered schist.

Pergelic Cryorthents are Orthents with mean annual temperatures below freezing and with no bedrock within 20 inches (50 cm). These soils occur above tree line in many parts of Alaska, but they normally make up only a small proportion of the soils in any single area. Most of the soils are gravelly and have rapid internal drainage. The permafrost table is commonly many feet deep, but the soils are almost always associated with Pergelic Cryaquepts and Histic Pergelic Cryaquepts, both of which have a shallow permafrost table.

In terraces along many of the major rivers in the Arctic and on some beach ridges, the soils are very gravelly.

Pedon *16*, Pergelic Cryorthents, very gravelly (unnamed series). About 1 mile (1.6 km) south of Anaktuvuk Pass.

O1—1½ inches to 0 (4–0 cm); dark reddish brown (5Y 2/2) coarse organic materials; many roots; abrupt smooth boundary.

C1—0 to 6 inches (0–15 cm); very dark grayish brown (2.5Y 3/2) very gravelly loamy fine sand; single grain; loose; contains thin broken layers of very dark gray (10YR 3/1) fine organic material; few roots; neutral; clear smooth boundary.

C2—6 to 20 inches (15–50 cm); dark grayish brown (2.5Y 4/2) very gravelly sand; single grain; loose; few pockets of black coarse organic material; calcareous.

Pergelic Cryorthents are common on outcrops of limestone. These soils are much disturbed by frost action; 40 to 80 percent of the soil surface may be occupied by bare frost scars, stone stripes, and other frost features. In places subject to high winds, all fine-grained material may have been blown from the upper few inches, leaving a residue of angular, frost-rived gravel.

Pedon *17*, Pergelic Cryorthents, very gravelly (unnamed series). About 1.5 miles (2.5 km) east of mouth of Lost River, Seward Peninsula.

C1—0 to 1 inch (0–2 cm); gray angular limestone gravel.

C2—1 to 5 inches (2–12 cm); pale brown (10YR 6/3) very gravelly silt loam; weak fine granular structure; very friable; common roots; many fine vesicles; calcareous; abrupt wavy boundary.

C3—5 to 16 inches (12–40 cm); brown (10YR 5/3) very gravelly silt loam; streak of dark brown (7.5YR 3/2) leading diagonally downward from dryas patch; weak fine subangular blocky structure; very friable; few roots; silt coatings on upper surfaces of pebbles and lime incrustations on lower surfaces; gravel coarser than in horizons above, mostly channery fragments more than 4 inches in length; calcareous; clear wavy boundary.

C4—16 to 40 inches (40–100 cm); pale brown (10YR 6/3) very gravelly silt loam; weak fine subangular blocky structure; very friable; no roots; calcareous.

These soils also occur on other gravelly parent material, including glacial till and weathered metamorphic rock.

Pedon *18*, Pergelic Cryorthents, very gravelly (McKinley series). Eagle Summit, Steese Highway.

O1—2½ inches to 0 (6–0 cm); very dark brown (10YR 2/2) partly decomposed organic material; many roots; abrupt smooth boundary.

A1—0 to 2 inches (0–5 cm); very dark grayish brown (10YR 3/2) very gravelly silt loam; weak very fine crumb structure; very friable; many roots; strongly acid; abrupt broken boundary.

AC—2 to 5 inches (5–12 cm); brown (10YR 4/3) very gravelly silt loam; weak fine granular structure; very friable; common roots; strongly acid; clear broken boundary.

C1—5 to 12 inches (12–30 cm); dark grayish brown (2.5Y 4/2) very gravelly silt loam; weak very fine granular structure; very friable; few roots; slightly acid; clear smooth boundary.

C2—12 to 24 inches (30–60 cm); olive gray (5Y 4/2) very gravelly loam; many angular schist fragments; single grain; no roots; neutral.

On outcrops of bentonitic shale and in the Arctic Foothills, soils in positions with exceptionally good surface drainage have a deep permafrost table and are well drained. These Pergelic Cryorthents are unusual in that they are not gravelly.

Pedon *19*, Pergelic Cryorthents, clayey (unnamed series). Near Umiat.

C1—0 to 1½ inches (0–3 cm); gray (N 5/) silty clay;

strong fine and medium granular structure; firm; few roots; very strongly acid.

C2—1½ to 9 inches (3–22 cm) gray (N 5/) and dark gray (N 4/) silty clay; common medium distinct mottles of light olive brown (2.5Y 5/6) and very dark gray (N 3/) streaks; moderate thin platy structure; sticky and plastic; few roots; very strongly acid.

C3—9 to 18 inches (22–45 cm); dark gray (N 4/) silty clay; common medium distinct mottles of light olive brown (2.5Y 5/6); sticky and plastic; no roots; very strongly acid.

C4—18 to 52 inches (45–130 cm); gray (N 5/) and dark gray (N 4/) clay; light yellowish brown (2.5Y 6/4) and olive brown (2.5Y 4/4) convoluted streaks; strong thin platy structure; no roots; very strongly acid.

Psamments

Psamments are sandy soils with little or no admixture of finer material except in the upper 10 inches (25 cm) of the profile. They have a deep water table. These soils occur principally on sand dunes near the coast, in places bordering braided rivers and outwash plains, and in other areas dominated by sandy parent material. They exist in a variety of climates. Vegetation ranges from forest to coastal grasses and arctic tundra.

Typic Cryopsamments are Psamments with mean annual temperatures above freezing. These soils may have gray colors or may be brown or olive brown. On dunes that have been stable for some time under a permanent vegetation, they may exhibit incipient development of horizons characteristic of other orders.

Pedon *20*, Typic Cryopsamments, sandy (unnamed series). About 20 miles (32 km) south of Hog Landing, Koyukuk River:

O1—1 inch to 0 (2–0 cm); very dark brown (10YR 2/2) partially decomposed forest litter; many roots; extremely acid; abrupt smooth boundary.

A2—0 to 2 inches (0–5 cm); brown (7.5YR 5/4) fine sandy loam; weak fine granular structure; very friable; few roots; very strongly acid; abrupt smooth boundary.

B2—2 to 6 inches (5–15 cm); dark brown (7.5YR 4/4) loamy fine sand; weak fine granular structure; very friable; few roots; strongly acid; clear wavy boundary.

C1—6 to 40 inches (15–100 cm); olive brown (2.5Y 4/4) sand; single grain; loose; no roots; medium acid.

Pergelic Cryopsamments are the Psamments with mean annual temperatures below freezing. These soils are extensive in parts of the Arctic Coastal Plain and occur commonly in dunes along the coasts of the Arctic Ocean and the Bering Sea. They also occur in areas of sand dunes along the Kobuk River. The permafrost table is usually deep, but ice-rich permafrost may exist at depths of 2 to 5 feet (60 to 150 cm).

Pedon *21*, Pergelic Cryopsamments, sandy (unnamed series). About 40 miles (65 km) southeast of Barrow.

A1—0 to 2 inches (0–5 cm); very thin layer of plant litter over very dark grayish brown (10YR 3/2) fine sand; weak fine granular structure; very friable; many roots; mildly alkaline; clear wavy boundary.

C1—2 to 10 inches (5–25 cm); olive (5Y 4/3) fine sand; single grain; loose; undulating discontinuous band of black (5Y 2/1) organic matter about ¼ to ½ inch (0.5 to 1 cm) thick between depths of 5 to 8 inches (12 to 20 cm); common roots; mildly alkaline; clear wavy boundary.

C2—10 to 28 inches (25–70 cm); olive (5Y 4/3) fine sand; patches of very dark grayish brown (2.5Y 3/2); single grain; loose; mildly alkaline.

C3f—28+ inches (70+ cm); same as horizon above, but frozen in midsummer.

Histosols

Histosols are made up completely or in large part of organic material. The organic material accumulates under wet conditions, in depressions or other low areas that are nearly always inundated, on slopes affected by seepage, or as a blanket on rolling hills in areas of very high rainfall. The only organic soils that have formed under well drained conditions are soils in areas with high rainfall in southern Alaska that consist of plant litter resting directly on bedrock or fragmental material.

For classification in the order of Histosols, the organic material must be at least 16 inches (40 cm) thick except where bedrock or fragmental material is at a shallower depth. If the organic material consists principally of undecomposed moss, it must be more than 24 inches (60 cm) thick. Mineral layers, including a surface layer up to 16 inches (40 cm) thick, are permitted in soils classified as Histosols, but at least half (three-quarters in undecomposed moss) of the upper 32 inches (80 cm) must be organic. The organic material may be mostly undecomposed (fibric), partially decomposed (hemic), or nearly completely decomposed (sapric). Many organic soils have layers with varying degrees of decomposition within the soil profile. Some include or are underlain by layers of coprogenous earth (fine fecal pellets), marl, or diatomaceous earth.

Histosols that are seldom saturated are separated at the suborder level from other Histosols. Except for those soils, classification at this level is based mostly on the degree of decomposition of organic material in the subsurface tier. This is defined as the section between depths of 12 to 36 inches (30 to 90 cm), or 24 to 48 inches (60 to 120 cm) if sphagnum moss is dominant in the upper 24 inches (60 cm). If a mineral substratum, bedrock, or permafrost occurs above 36 inches (90 cm) or 48 inches (120 cm), the entire thickness of the organic material is used.

Fibrists

Fibrists are Histosols in which the subsurface tier consists principally of undecomposed or only slightly decomposed organic material. It is always possible in this material to determine the botanic origin of the plant remains that make up the soil. The peat is usually fluffy and light in weight when dried, especially if it is sphagnum moss. Some fibric sedge peats, however, are compressed into layers and are somewhat heavier.

Fibrists occur in all parts of Alaska. In southeastern Alaska and in areas bordering the north coast of the Gulf of Alaska, they occur as a blanket over low rolling moraines or in depressions on nearly level benches in uplands. Over the rest of the State they are generally confined to low areas, but a few occur on steep north-facing slopes, which receive little direct sunlight. Fibrists in Alaska are composed principally of sphagnum moss peat and sedge peat, either alone or in layers of varying thickness.

Sphagnic Borofibrists are deep organic soils composed dominantly of sedge peat, but with one or more layers (normally close to the surface) in which sphagnum moss fibers make up more than three-quarters of the peat. The soils have no permafrost but are frozen

to a depth of 2 inches (5 cm) or more during winter. These soils occur in the Cook Inlet-Susitna Lowland and adjacent mountains and, to a much lesser extent, in the southernmost part of the Kuskokwim Highlands. They support either vegetation dominated by mosses, sedges, and low shrubs, or a black spruce forest.

Pedon *22*, Sphagnic Borofibrists (Salamatof series). About 9 miles (14 km) west of Caswell (*54*).

Oi1—0 to 9 inches (0–22 cm); brown (10YR 4/3) when wet to pale brown (10YR 6/3) when squeezed dry, raw, undecomposed sphagnum moss peat; many roots; many dark colored, coarse woody particles; extremely acid; gradual boundary.

Oi2—9 to 60 inches (22–150 cm); dark brown (7.5YR 3/2) when wet to brown (7.5YR 4/2) when squeezed dry, coarse moss peat; a few thin strata of coarse sedge peat; a few woody particles; a few live roots to a depth of 18 inches (46 cm); peat material is slightly finer below a depth of 24 inches (61 cm); extremely acid.

Terric Borofibrists are organic soils composed dominantly of sedge peat that is less than 51 inches (130 cm) thick over a mineral substratum and that freeze to depths of at least 2 inches (5 cm) in winter. These soils occur mostly over a substratum of tide-deposited silt or clay along the coast of Cook Inlet. The soils are inextensive.

Pedon *23*, Terric Borofibrists (Clunie series). About 6 miles (10 km) southwest of Knik (*57*).

Oi1—0 to 11 inches (0–28 cm); raw moss and sedge peat with admixture of very dark gray (5Y 3/1) silt loam; many fine roots; strongly acid; abrupt smooth boundary.

Oi2—11 to 27 inches (28–68 cm); moss and sedge peat; dark reddish brown (5YR 2/2) when moist, brown or dark brown (7.5YR 4/4) when squeezed dry; few woody fragments; roots common to a depth of 20 inches (51 cm); slightly acid; abrupt smooth boundary.

C1—27 to 33 inches (68–82 cm); dark gray (N 4/) clay and silty clay loam with layers of sedge and moss peat; slightly sticky, slightly plastic; slightly acid; abrupt smooth boundary.

C2—33 to 48 inches (82–120 cm); greenish gray (5BG 5/1) silty clay loam; massive; slightly sticky, slightly plastic; few roots; slightly acid.

Fluvaquentic Cryofibrists remain unfrozen throughout the year and contain thin layers of mineral material at depths greater than 12 inches (30 cm). In Alaska, these soils are composed principally of sedge peat. They occur in flood plains in southeastern Alaska and in both flood plains and coastal plains in the Alaska Peninsula and Southwestern Islands Major Land Resource Area, where the mineral layers are made up of volcanic ash. The vegetation is almost entirely sedges.

Pedon *24*, Fluvaquentic Cryofibrists (Saltery series). About 1 mile (1.6 km) north of Umnak Airstrip.

Oi1—0 to 28 inches (0–70 cm); very dark brown (10YR 2/2) to very dark grayish brown (10YR 3/2, squeezed dry) fibrous sedge peat; common strata of dark gray (N 4/) silt loam and fine sand volcanic ash; many roots; extremely acid; clear smooth boundary.

Oi2—28 to 42 inches (70–105 cm); very dark gray (10YR 2/2) to dark grayish brown (10YR 4/2, squeezed dry) fibrous sedge peat; lenses of sandy volcanic ash; many roots; extremely acid.

Pergelic Cryofibrists are fibrous organic soils that have mean annual soil temperatures below freezing. The permafrost table is commonly less than 30 inches (75 cm) deep in these soils. The soils are composed dominantly of laminated or felty sedge peat, but in many places the upper part of the soil consists of sphagnum moss peat. The thickness of the peat ranges from 16 inches (40 cm) to more than 10 feet (3 m). The soils occupy shallow depressions in lowlands throughout interior, arctic, and western Alaska. The vegetation is dominantly sedge tussocks or, in the interior, black spruce forests. Polygonal patterns are normally evident on the surface except in forested areas (fig. 4).

Pedon *25*, Pergelic Cryofibrists (Lemeta series). About 13 miles (21 km) northwest of Fairbanks.

Oi1—0 to 11 inches (0–28 cm); reddish brown (5YR 4/4) sphagnum moss peat, pink (5YR 7/3) when pressed; 100 percent fiber after rubbing; loose mat; many roots; extremely acid; abrupt smooth boundary.

Oi2—11 to 13 inches (28–32 cm); dark reddish brown (5YR 3/2) moss and sedge peat, dark reddish brown (5YR 3/3) when pressed; 90 percent fiber after rubbing; strongly acid; abrupt smooth boundary.

Oi3—13 to 23 inches (32–58 cm); reddish brown (5YR 3/4) sphagnum moss peat, dark brown (7.5YR 4/4) rubbed, yellowish red (7.5YR 5/6) pressed; 100 percent fiber after rubbing, arranged in thin cohesive layers; no live roots; very strongly acid; abrupt smooth boundary.

Oi4—23 to 32 inches (58–80 cm); dark reddish brown (5YR 2/2) sedge peat, dark reddish brown (5YR 3/2) rubbed, dark reddish brown (5YR 3/3) pressed; 100 percent fiber rubbed; arranged in thin cohesive layers; no live roots; very strongly acid. Frozen below 32 inches.

Terric Cryofibrists are composed dominantly of sedge peat and are less than 51 inches (130 cm) thick over a mineral substratum. They seldom freeze deeply in winter. In Alaska, most of these soils contain layers of volcanic ash. They occur in flood plains and coastal plains on the Alaska Peninsula and in areas bordering Bristol Bay and the Bering Sea.

Typic Sphagnofibrists are composed dominantly of sphagnum moss peat, though layers of sedge peat occur commonly in the lower part of the organic soil. They are unfrozen throughout the year. The soils are at least 63 inches (160 cm) thick, and in many cases are thicker than 10 feet (3 m) over a mineral substratum. They occur mostly over glacial deposits in southeastern Alaska and in areas bordering the north coast of the Gulf of Alaska, on benches and in depressions in uplands and on rolling foothills. In the uplands, the surface of the peat is commonly domed, with centers of the bogs higher than the edges. On foothills the peat mantles the rolling landscape. A placic horizon commonly occurs directly beneath the contact between the peat and the underlying compact till. The vegetation is mostly a complex of mosses, sedges, and low shrubs and forbs. In places the soils support scrubby lodgepole pine.

Pedon *26*, Typic Sphagnofibrists (Kogish series). Near Hollis, Prince of Wales Island.

Oi1—0 to 3 inches (0–8 cm); living mosses and sedges, with some twigs and leaves.

Oi2—3 to 6 inches (8–15 cm); very dusky red (2.5YR 2/2) to dark reddish brown (5YR 3/3, squeezed dry) moss peat; fibrous; slightly decomposed organic matter; many fine and common medium matted roots; extremely acid; clear wavy boundary.

Oi3—6 to 12 inches (15–30 cm); very dusky red (2.5YR 2/2) to dark reddish brown (2.5YR 2/4, squeezed dry) fibrous moss peat; slightly decomposed remains of sedges, forbs, and shrubs; many fine and common medium roots; extremely acid; clear smooth boundary.

Oi4—12 to 22 inches (30–55 cm); brown (10YR 4/3) to light yellowish brown (10YR 6/4, squeezed dry) finely

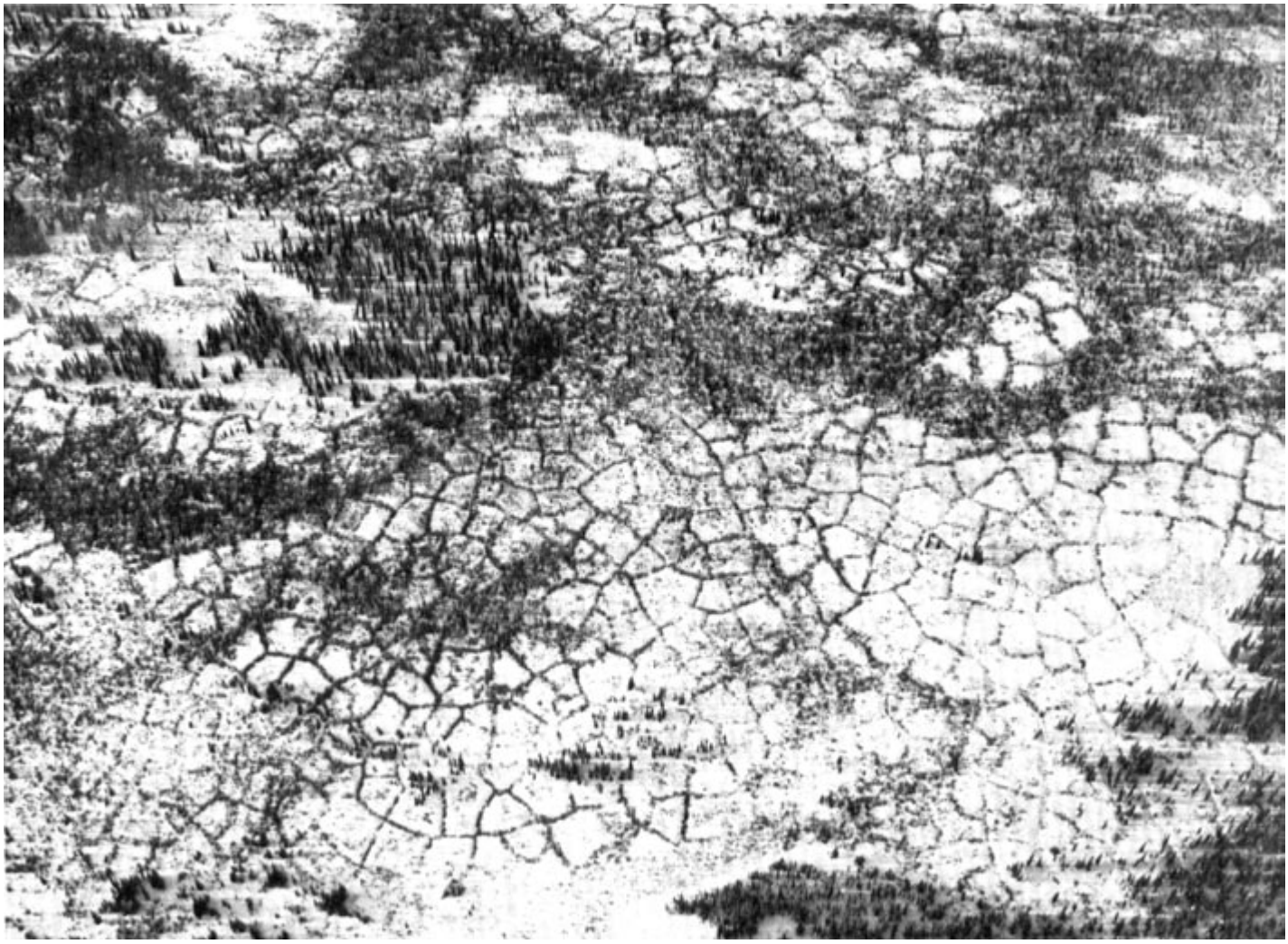

Figure 4.—**Muskeg area in Yukon Flats. Polygonal ground patterns formed as a result of the development of ice wedges in the underlying permafrost.**

layered fibrous moss peat; dark brown (7.5YR 3/2) stains; slightly decomposed remains of sedges, forbs, and shrubs; common fine and few medium roots; extremely acid; gradual smooth boundary.

Oi5—22 to 46 inches (55–115 cm); yellowish brown (10YR 5/6) to very pale brown (10YR 7/4, squeezed dry) peat; slightly decomposed organic matter consisting mainly of mosses with some sedges, forbs, and shrubs; common fine roots; extremely acid; clear smooth boundary.

Oi6—46 to 78 inches (115–195 cm); very dark brown (10YR 2/2) to dark yellowish brown (10YR 3/4, squeezed dry) peat; slightly to moderately decomposed organic matter derived from mosses, sedges, forbs, and shrubs; extremely acid; clear smooth boundary.

Oe1—78 to 84 inches (195–210 cm); very dark brown (10YR 2/2, wet and squeezed dry) peat with a slightly silty feel; few small woody remains; extremely acid.

Terric Sphagnofibrists are similar in most respects to Typic Sphagnofibrists but are only 24 to 63 inches (60 to 160 cm) thick over a mineral substratum. These soils occur most commonly on outwash plains or near the mouths of streams flowing into tidewater, in association with Typic Cryaquents. The substratum is normally silty but may consist of sand and gravel.

Pedon *27*, Terric Sphagnofibrists (unnamed series). About 11 miles (18 km) northwest of Auke Bay.

Oi1—0 to 18 inches (0–45 cm); brown (10YR 5/3) sphagnum moss peat, very pale brown (10YR 7/4) when pressed; 90 percent fiber, 75 percent rubbed; about 80 percent sphagnum moss fibers and 20 percent sedge; gradual boundary.

Oi2—18 to 24 inches (45–60 cm); dark brown (10YR 4/3) peat, light yellowish brown (10YR 6/4) when pressed; 80 percent fiber, 60 percent rubbed; about 75 percent of the fibers are sphagnum moss and 25 percent sedge; clear smooth boundary.

IIC1g—24 to 60 inches (60–150 cm); dark greenish gray (5GY 4/1) silt; massive; slightly sticky, nonplastic; medium acid.

Folists

Folists are made up principally of forest or other plant litter similar to that over mineral soils. Less than 4 inches of mineral soil is between the bottom of the litter and the upper surface of consolidated bedrock, or the litter rests directly on fragmental material consisting only of gravel, stones, or boulders.

The spaces between the coarse fragments are filled or partially filled with organic material. Unlike other Histosols, the Folists, though usually moist, are not continually saturated under natural conditions. They occur in southeastern Alaska, in areas bordering the north coast of the Gulf of Alaska, and on the Aleutian Islands, where precipitation rates are very high and soils are seldom frozen. Water percolates freely through the litter in all seasons. In southeastern Alaska and the Gulf coast the soils support forests of Sitka spruce, western hemlock, and cedars that are identical with those on adjoining mineral soils but that have somewhat slower growth rates. On the Aleutian Islands they support low tundra vegetation.

Typic Cryofolists are the Folists in which organic material either overlies or is interspersed with gravel, stones, or boulders. They occur principally on old beach ridges and talus slopes. The total extent of these soils is small.

Pedon *28*, Typic Cryofolists (Sokolof series). Shore of Totem Bay, Kupreanof Island.

Oi1—0 to 1 inch (0–2 cm); undecomposed forest litter and living mosses; abrupt smooth boundary.

Oe1—1 to 11 inches (2–28 cm); reddish black (10R 2/1) and very dusky red (10R 2/2) partially decomposed forest litter; about 60 percent fibers, 30 percent when rubbed; many fine, medium, and coarse roots; extremely acid; abrupt wavy boundary.

C1—11 to 12 inches (28–30 cm); grayish brown (10YR 5/2) very gravelly silt loam; weak fine subangular blocky structure; very friable; about 40 percent coarse fragments by volume; common fine, medium, and coarse roots; extremely acid; abrupt broken boundary.

Oa1—12 to 40 inches (30–100 cm); black (5YR 2/1) to dark reddish brown (5YR 2/2, rubbed) mucky gravel; 95 percent coarse fragments by volume, with interstices mostly filled by organic matter; organic matter contains about 10 percent fibers, trace when rubbed; common fine and medium roots; extremely acid.

Lithic Cryofolists consist of litter separated from underlying consolidated bedrock by less than 4 inches (10 cm) of mineral soil. The litter ranges in thickness from about 6 inches (15 cm) to 30 inches (75 cm). These soils are extensive and occur commonly in close association with Lithic Humic Cryorthods.

Pedon *29*, Lithic Cryofolists (McGilvery series). Near Karta Bay, Prince of Wales Island.

Oi1—0 to 1 inch (0–2 cm); undecomposed litter of twigs, needles, cones, and live mosses.

Oi2—1 to 11 inches (2–28 cm); very dusky red (2.5YR 2/2) and black (5YR 2/1) forest litter; many fine medium and coarse roots; extremely acid; abrupt smooth boundary.

IIC1—11 to 15 inches (28–38 cm); dark gray (10YR 4/1) very gravelly silt loam; weak, very fine subangular blocky structure; friable; nonsticky, nonplastic; 75 percent gravel and stone by volume; many fine, medium, and coarse roots; very strongly acid; abrupt smooth boundary.

R—15+ inches (38+ cm); fine-grained graywacke.

Hemists

Hemists are Histosols in which material in the subsurface tier is so decomposed that most, but not all, of the plant fibers in the peat can be destroyed by rubbing between the fingers. In Alaska, this partially decomposed organic material is derived mostly from sedges. Fibrous moss or sedge peat may overlie the hemic layer, and woody fragments may be present at any depth. Hemists occur primarily in southern Alaska, but some occur in the interior and, rarely, near water bodies in tundra areas. They occupy nearly level depressions, seep slopes, and areas above tree line in coastal regions. Most Hemists are treeless, but some support black spruce or, especially in southeastern Alaska, poor stands of commercial species.

Typic Borohemists are composed dominantly of partially decomposed peat with no lenses of mineral soil. They freeze deeply each winter, but have no permafrost. The vegetation is made up principally of sedges. These soils occur in depressions in foothills bordering mountains in south central Alaska.

Fluvaquentic Borohemists consist of thick, partially decomposed organic material that freezes deeply every winter but is not perennially frozen. Thin lenses of volcanic ash are common. Most areas of these soils are covered by sedges and patches of sphagnum moss, but a few support a birch forest. The soils are predominantly in the southern part of the Cook Inlet-Susitna Lowland.

Pedon *30*, Fluvaquentic Borohemists (Starichkof series). About 13 miles (21 km) northeast of Homer (*30*).

Oi1—0 to 7 inches (0–18 cm); raw sedge peat that is dark reddish brown (5YR 2/2 moist, 5YR 3/2 squeezed dry); many roots; very strongly acid; abrupt smooth boundary.

C1—7 to 9 inches (18–22 cm); volcanic ash consisting of dark grayish brown (2.5Y 3/2) silt loam; weak very thin platy structure; very friable; many roots; very strongly acid; abrupt smooth boundary.

Oe1—9 to 42 inches (22–105 cm); very dark brown (10YR 2/2), finely divided laminated sedge peat; thin discontinuous lenses of sandy and silty volcanic ash; very strongly acid.

Terric Borohemists are similar to the Fluvaquentic Borohemists in most respects but are shallower than 51 inches (130 cm) over a mineral substratum and may or may not have layers of volcanic ash in the peat. In most places the peat overlies gravelly compact glacial till, but in some areas the substratum is waterlaid very gravelly sand. These soils occur mainly in the Cook Inlet-Susitna Lowland.

Pedon *31*, Terric Borohemists (Doroshin series). About 8 miles (13 km) north of Kenai.

Oi1—0 to 6 inches (0–15 cm); very dark grayish brown (10YR 3/2, moist) to light yellowish brown (10YR 6/4, squeezed dry) moss peat; strongly acid.

Oe1—6 to 19 inches (15–48 cm); dark reddish brown (5YR 2/2 moist, 5YR 3/2 squeezed dry) finely divided peat; many fine roots; strongly acid; abrupt wavy boundary.

IIC—19 to 30 inches (48–75 cm); dark brown (7.5YR 3/2, wet) silt loam; common medium distinct mottles of pale brown (10YR 6/3); massive; nonsticky; roots common to few; pockets and thin lenses of fine sand near upper boundary; strongly acid; many feet thick.

Typic Cryohemists consists of more than 51 inches (130 cm) of partially decomposed sedge peat that remains unfrozen throughout the year. Woody fragments are common in the peat, and there may be a a thin surface layer of sphagnum moss peat. These soils occur principally on slopes affected by seepage in southeastern Alaska and in coastal areas of the South Central Alaska Mountains Major Land Resource Area. The underlying material is normally compact glacial till. Most of the soils are covered by sedges and

associated forbs, but many support a slow-growing forest of hemlock, cedar, and lodgepole pine.

Pedon *32*, Typic Cryohemists (Kina series). About 30 miles (48 km) northwest of Juneau.

Oi1—0 to 5 inches (0–12 cm); dark reddish brown (5YR 2/2) peat; 85 percent fiber, 70 percent after rubbing; about 60 percent of the fibers are sedge and 35 percent moss; many roots; very strongly acid; clear smooth boundary.

Oe1—5 to 40 inches (12–100 cm); dark brown (7.5YR 3/2) peat; 70 percent sedge fibers, 20 percent after rubbing; common roots; very strongly acid; clear smooth boundary.

Oa1—40 to 60 inches (100–150 cm); very dark grayish brown (10YR 3/2) peat; 40 percent fibers, 10 percent after rubbing; very strongly acid.

Lithic Cryohemists have consolidated bedrock under less than 51 inches (130 cm) of partially decomposed sedge peat. The soils mostly occupy areas directly above tree line in southeastern and south central Alaska. In a few areas bordering Prince William Sound they occur close to sea level. Although air temperatures are often low in winter, the snow cover is so thick that the soils seldom freeze. The vegetation is dominated by sedges and associated low-growing shrubs and forbs.

Pedon *33*, Lithic Cryohemists (Hydaburg series). About 9 miles (14 km) north of Hollis, Prince of Wales Island.

Oi1—0 to 1 inch (0–2 cm); living sedges, mosses, and other plants.

Oi2—1 to 5 inches (2–12 cm); dark brown (7.5YR 3/2) sedge peat; very fibrous; extremely acid; clear wavy boundary.

Oe1—5 to 13 inches (12–32 cm); dark reddish brown (5YR 3/3) partly disintegrated sedge peat; many very fine roots; extremely acid; abrupt wavy boundary.

Oa1—13 to 18 inches (32–45 cm); black (5YR 2/1) mucky peat; common fine roots; extremely acid; abrupt wavy boundary.

IIC—18 to 23 inches (45–58 cm); olive gray (5Y 4/2) very gravelly loam; massive; friable to slightly brittle; 60 percent gravel and stones by volume; few very fine roots; strongly acid; abrupt wavy boundary.

R—23+ inches (58+ cm); graywacke.

Pergelic Cryohemists have mean annual temperatures below freezing and are underlain by ice-rich permafrost. They are made up dominantly of sedge peat. Depth to the mineral substratum varies, but in nearly all areas the lower part of the peat is perennially frozen. These soils occur, mostly, in shallow depressions or moraines and outwash plains north of the Alaska Range and on river terraces elsewhere in interior Alaska. They occur also on coastal plains and deltas of arctic and western Alaska, where they contain layers of silty alluvial and tidal deposits.

Pedon *34*, Pergelic Cryohemists (unnamed series). Near Kaltag.

Oi1—0 to 4 inches (0–10 cm); dark brown (10YR 4/3) undecomposed sphagnum moss peat; extremely acid.

Oe1—4 to 42 inches (10–110 cm); dark reddish brown (5YR 2/2) partially decomposed sedge peat; many roots to 20 inches (50 cm); extremely acid; frozen at 42 inches (110 cm) in midsummer.

Terric Cryohemists are similar to Typic Cryohemists but are shallower over the mineral substratum. They occupy slopes of glacial moraines that are affected by seepage and shallow depressions in outwash plains and deltas. They occur only in coastal regions bordering the Gulf of Alaska.

Pedon *35*, Terric Cryohemists (Unakwik series). About 8 miles (13 km) east of Whittier.

Oi1—0 to 3 inches (0–8 cm); dark reddish brown (5YR 3/3 broken face, 5YR 3/4 pressed and rubbed) fibric peat; 90 percent fibers, 75 percent rubbed; many fine roots; very strongly acid; clear smooth boundary.

Oe1—3 to 5½ inches (8–14 cm); dark reddish brown (5YR 3/3 broken face, pressed and rubbed) hemic peat; 80 percent fibers, 50 percent rubbed; many fine roots; very strongly acid; clear smooth boundary.

Oe2—5½ to 11 inches (14–28 cm); dark reddish brown (5YR 3/2 broken face, 5YR 3/3 pressed and rubbed) hemic peat; 50 percent fibers, 40 percent rubbed; few roots; strongly acid; abrupt smooth boundary.

IIC1—11 to 11½ inches (28–29 cm); volcanic ash. Dark grayish brown (10YR 4/2) fine sandy loam; massive; very friable; few roots; strongly acid; abrupt smooth boundary.

Oe3—11½ to 27½ inches (29–68 cm); dark reddish brown (5YR 3/2 broken face, 5YR 3/3 pressed and rubbed) hemic peat; 60 percent fibers, 30 percent rubbed; few roots; strongly acid; abrupt smooth boundary.

IIC2—27½ to 28 inches (70–71 cm); volcanic ash. Similar to horizon IIC1.

Oe4—28 to 49 inches (71–124 cm); dark reddish brown (5YR 3/3 broken face, 5YR 3/2 pressed and rubbed) hemic peat; 50 percent fibers, 20 percent rubbed; few roots; strongly acid; abrupt smooth boundary.

IIIC3—49 to 70 inches (124–178 cm); gray very stony silt loam; massive; firm; no roots; strongly acid.

Saprists

Saprists are Histosols in which the subsurface tier consists mainly of highly decomposed organic material in which few, if any, of the original plants can be identified. They are most common in areas with high rainfall bordering the Gulf of Alaska, but they also occur in other parts of the State. Many Saprists support commercial forests but with lower growth rates than on adjoining mineral soils. Others are covered with sedges and grasses. Saprists occur most commonly on slopes affected by seepage, but they also occur in coastal areas and in areas above tree line where there is no permafrost.

Terric Borosaprists are less than 51 inches (130 cm) thick over a mineral substratum. They are inextensive in Alaska and have been observed only in shallow depressions near the coast of Cook Inlet. Many, especially in the southern part of their range, contain lenses of volcanic ash. These soils freeze deeply in winter.

Pedon *36*, Terric Borosaprists (Nikolai series). About ½ mile (1 km) southwest of Ninilchik (*30*).

Oi1—0 to 4 inches (0–10 cm); mat of partly decomposed grass and other plants.

Oa1—4 to 9 inches (10–22 cm); black (5YR 2/1) muck; weak very fine granular structure; smeary when rubbed; many roots; very strongly acid; abrupt wavy boundary.

Oa2—9 to 14 inches (22–35 cm); dark reddish brown (5YR 3/3) mucky silt loam; patches of pale brown (10YR 6/3); weak very fine subangular blocky structure; smeary when rubbed; common roots; very strongly acid; abrupt irregular boundary.

C1—14 to 18 inches (35–45 cm); pale brown (10YR 6/3) silt loam; streaks of brown (7.5YR 4/4); weak fine angular blocky structure; smeary when rubbed; common roots; horizon is discontinuous; very strongly acid; abrupt broken boundary.

Oa3—18 to 26 inches (45–65 cm); dark brown (7.5YR 3/2) mucky silt loam; thin lenses of pale brown (10YR 6/3) volcanic ash of silt loam and very fine sand texture;

moderate thin platy structure; smeary when rubbed; common roots; very strongly acid; abrupt smooth boundary.

Oa4—26 to 35 inches (65–78 cm); black (5YR 2/1) muck and lenses of silt loam, probably volcanic ash; moderate, thin, platy structure; common roots; very strongly acid; abrupt smooth boundary.

IIC2—35 to 44 inches (78–100 cm); greenish gray (5GY 5/1) silt loam; common medium prominent mottles of light olive brown (2.5Y 5/4); massive; firm; few roots in upper part of horizon; fine vesicles; very strongly acid.

Lithic Cryosaprists are shallow over bedrock. Most occur in areas above tree line in southeastern Alaska under a vegetation dominated by low shrubs and forbs. A few occur on steep slopes just below the tree line, and are forested. Although winter air temperatures are low, the snow cover is thick enough so that the soils seldom freeze.

Pedon *37*, Lithic Cryosaprists (Sunnyhay series). About 4 miles (6 km) northwest of head of Karta Bay, Prince of Wales Island.

Oi1—0 to ½ inch (0–1 cm); undecomposed mat of grasses, sedges, and forbs.

Oa1—½ to 4 inches (1–10 cm); dark reddish brown (5YR 2/2) well decomposed mucky peat; common fine roots; extremely acid; gradual wavy boundary.

Oa2—4 to 11 inches (10–28 cm); black (5YR 2/1) mucky peat; common fine roots; very strongly acid; clear wavy boundary.

IIC—11 to 14 inches (28–35 cm); dark reddish brown (5YR 2/2) very stony loam with splotches of dark yellowish brown (10YR 4/4); single grain; nonsticky, nonplastic; few fine roots; 60 percent gravel and stones by volume; very strongly acid; abrupt wavy boundary.

R—14+ inches (35+ cm); graywacke.

Terric Cryosaprists have less than 51 inches (130 cm) of organic material and remain unfrozen throughout the year. These soils occur on slopes affected by seepage in southeastern Alaska and areas bordering the north coast of the Gulf of Alaska, commonly in close association with Typic Cryohemists. They are generally forested.

Pedon *38*, Terric Cryosaprists (Maybeso series). About 2 miles (3 km) east of head of Thorne Bay, Prince of Wales Island.

Oi1—0 to ½ inch (0–1 cm); living mosses and partially decomposed forest litter; abrupt wavy boundary.

Oa1—½ to 4 inches (1–10 cm); black (5YR 2/1, wet or squeezed) mucky peat; about 80 percent fiber unrubbed, 50 percent rubbed; liquid removed by squeezing is turbid; common fine and medium roots and few coarse roots; extremely acid; clear wavy boundary.

Oa2—4 to 13 inches (10–32 cm); dark reddish brown (5YR 2/2, wet or squeezed) muck; about 15 percent fiber unrubbed, trace when rubbed; liquid removed by squeezing is turbid; nonsticky, slightly plastic; few skunk cabbage roots; very strongly acid; clear wavy boundary.

Oa3—13 to 23 inches (32–58 cm); black (5YR 2/1, wet or squeezed) mucky peat; about 40 percent fiber unrubbed, 5 percent rubbed; liquid removed by squeezing is turbid; about 10 percent wood by volume; few skunk cabbage roots; very strongly acid; clear wavy boundary.

IIC1—23 to 26 inches (58–65 cm); very dark brown (10YR 2/2) gravelly sandy loam with pockets of sedge peat; massive; nonsticky, slightly plastic; very strongly acid; clear wavy boundary.

IIC2—26 to 51 inches (65–128 cm); olive gray (5Y 4/2) very gravelly sandy loam; massive; weakly cemented; about 60 percent gravel and cobblestones by volume; very strongly acid.

Inceptisols

In Inceptisols there has been only relatively minor modification of the parent material by soil-forming processes. The modification has been sufficient to distinguish the soils from Entisols, but not intense enough to form the kinds of horizons that are required for classification in other soil orders. In general, soils are classified as Inceptisols if they have an umbric epipedon, a histic epipedon composed of mixed mineral and organic material or a cambic horizon and no other diagnostic horizons. There are, however, some exceptions to this rule. Poorly drained soils with permafrost are considered to be Inceptisols even though they have no diagnostic horizon other than an ochric epipedon. Soils with a mollic epipedon are Inceptisols if the epipedon overlies ashy material or a cambic horizon with base saturation of less than 50 percent.

Most soils in Alaska are Inceptisols. Except in Southeastern Alaska, the South Central Alaska Mountains, and the Cook Inlet-Susitna Lowland, they are dominant in all of the major land resource areas. They formed in many different parent materials and under a wide range of climatic conditions and vegetative types.

Andepts

Andepts are the Inceptisols formed in volcanic ash. They mostly are dark brown to dark reddish brown. Many have buried surface horizons because of repeated deposits of ash. These are the dominant soils in the Alaska Peninsula and Southwestern Islands. They also occur close to active volcanoes of the Aleutian Range.

Soil particles range in size from cinders to clay. The clay has thixotropic properties. It releases large quantities of water and assumes fluid properties when subjected to pressure and returns to its original rigid state when pressure is released. All of the Andepts are light. Weight per unit volume is lower than that of water.

The principal vegetative cover on Andepts in Alaska is tall grass or a combination of grass and alder. Low shrubs dominate, however, at higher elevations and in level areas unprotected from strong winds, especially on the Alaska Peninsula and Aleutian Islands, and in an area north and west of Iliamna Lake. In the northern part of the Kodiak Island group, Andepts support forests of Sitka spruce.

Typic Cryandepts are those in which less than half of the soil between depths of 10 and 40 inches (25 and 100 cm) exhibits thixotropic properties. They generally are dark reddish brown or dark brown. Some are made up mostly of ash grains of sand or cinder size. Others consist of fine thixotropic ashy material that is fairly thin over other material.

Pedon *39*, Typic Cryandepts, loamy (Umnak series). About ½ mile (1 km) northwest of west end of Fort Glenn Airstrip, Umnak Island.

A11—0 to 3 inches (0–8 cm); dark reddish brown (5YR 2/2) silt loam; weak very fine crumb structure; very friable; many roots; abrupt smooth boundary.

A12—3 to 6 inches (8–15 cm); dark reddish brown (5YR 2/2) silt loam; weak very fine granular structure; very friable; many roots; abrupt smooth boundary.

C1—6 to 19 inches (15–48 cm); black (10YR 2/1) loamy fine sand with about 10 percent by volume cinders less than one-half inch in diameter; pockets and streaks of very dark grayish brown (10YR 3/2) sandy loam; weak fine subangular blocky structure; very friable; roots common; abrupt smooth boundary.

C2—19 to 21 inches (48–52 cm); dark brown (7.5YR

2/2) silt loam; massive; friable; few roots; abrupt smooth boundary.

C3—21 to 26 inches (52–65 cm); very dark brown (10YR 2/2) coarse sand with thin strata of fine sandy loam; single grain; loose; no roots; clear smooth boundary.

C4—26 to 42 inches (65–105 cm); very dark brown (10YR 2/2) fine sand; stratified with fine sandy loam and thin strata of coarse and medium sand; massive; friable; no roots.

Pedon *39a*, Typic Cryandepts, sandy (Pustoi series). Umnak Island.

O1—3 to 0 inches (8–0 cm); dark reddish brown (5YR 2/2) partially decomposed organic mat of leaves, stems, and roots with a considerable admixture of silt loam; abrupt smooth boundary.

A11—0 to 2½ inches (0–6 cm); dark reddish brown (5YR 2/2) coarse sandy loam; weak fine granular structure; very friable; many roots; abrupt smooth boundary.

A12—2½ to 5 inches (6–12 cm); very dark brown (10YR 2/2) silt loam with a few discontinuous diagonal streaks of black (10YR 2/1); very weak very fine subangular blocky structure; very friable, but smeary and releases water when rubbed; common roots; abrupt smooth boundary.

C3—5 to 7 inches (12–18 cm); dark brown (7.5YR 3/2) silt loam; very weak very fine subangular blocky structure; very friable, but smeary and releases water when rubbed; common roots; abrupt smooth boundary.

C4—7 to 14 inches (18–35 cm); dark brown (7.5YR 3/2) coarse sand; single grain; loose; few roots; abrupt smooth boundary.

C5—14 to 17 inches (35–42 cm); dark brown (10YR 3/3) silt loam with thin seams of black (10YR 2/1) fine sand; weak very thin platy structure; friable, but smeary when rubbed; few roots; abrupt smooth boundary.

IIC6—17 to 40 inches (42–100 cm); very dark brown (10YR 2/2) cindery fine sand; single grain; loose; no roots.

Pedon *40*, Typic Cryandepts, loamy (Kachemak series). About 2 miles (3 km) north of Homer (*60*).

O1—3 inches to 0 (8–0 cm); mat of roots, leaves, and stems; much charcoal; thin lenses of white sand grains at base of horizon; abrupt smooth boundary.

C1—0 to 1 inch (0–2 cm); recent volcanic ash; dark brown (7.5YR 3/3) silt loam; weak very fine granular structure; very friable; common roots; abrupt wavy boundary.

C2—1 inch to 2 inches (2–5 cm); recent volcanic ash; dark reddish brown (5YR 3/4) silt loam; weak fine granular structure; very friable; common roots; abrupt wavy boundary.

O2b—2 to 2½ inches (5–6 cm); black (5YR 2/1) mat of burned grass and woody material; thin lenses of sand, probably ash; common roots; abrupt wavy boundary.

A1b—2½ to 5 inches (6–12 cm); dark brown (7.5YR 3/2) silt loam; weak very fine granular structure; very friable; releases water and becomes smeary when rubbed; common roots; abrupt wavy boundary.

B21b—5 to 7 inches (12–17 cm); very dusky red (2.5YR 2/2) silt loam; weak very fine granular structure; very friable; releases water and becomes smeary when rubbed; common roots; clear wavy boundary.

B22b—7 to 11 inches (17–27 cm); dark reddish brown (5YR 3/3) silt loam; weak very fine granular structure; very friable; releases water and becomes smeary when rubbed; common roots; gradual boundary.

B3b—11 to 14 inches (27–34 cm); dark reddish brown (5YR 3/3) silt loam with patches of dark brown (7.5YR 4/4); weak fine subangular blocky structure; very friable; releases water and becomes smeary when rubbed; common roots; gradual boundary.

C1b—14 to 17 inches (34–42 cm); dark brown (10YR 4/3) silt loam; weak medium subangular blocky structure; very friable; releases water and becomes smeary when rubbed; fine pores; abrupt wavy boundary.

IIC2—17 to 23 inches (42–57 cm); olive gray (5Y 5/2) silt loam streaked with dark grayish brown (2.5Y 4/2); moderate medium platy parting to weak very fine angular blocky structure; friable; few pebbles; fine pores; gradual boundary.

IIIC3—23 to 29 inches (57–72 cm); olive gray (5Y 5/2) silt loam with common medium faint mottles of olive brown; moderate thin platy structure; friable; few pebbles; fine pores; abrupt smooth boundary.

IVR—29 inches (72 cm); moderately indurated shale.

Dystric Cryandepts exhibit thixotropic properties in more than half of the soil between depths of 10 and 40 inches (25 and 100 cm). Typically they are strongly acid and very dark. Organic matter percentages are high. It may approach or even exceed in some horizons the minimum organic matter content required for Histosols. Many of the soils have several sequences of horizons developed during periods between ash falls.

Pedon *41*, Dystric Cryandepts, loamy (unnamed series). North side of Kaiugnak Bay, Kodiak Island.

O1—8½ to 5 inches (22–12 cm); dark reddish brown (5YR 2/2) partially decomposed organic material; many roots; abrupt smooth boundary.

O2—5 inches to 0 (12–0 cm); black (5YR 2/1) silt loam; weak very fine granular structure; very friable, but releases water and becomes smeary when rubbed; many roots; clear smooth boundary.

A11—0 to 2½ inches (0–6 cm); dark reddish brown (5YR 2/2) silt loam; weak very thin platy structure; smeary when rubbed; common roots; clear smooth boundary.

A12—2½ to 6¾ inches (6–16 cm); dark reddish brown (5YR 3/2) silt loam; very weak very thin platy structure; smeary when rubbed; common roots; fine tubular pores; clear smooth boundary.

A11b—6¾ to 11 inches (16–28 cm); very dark brown (10YR 2/2) silt loam; streaks and patches of dark brown (10YR 3/2); weak very thin platy structure; smeary when rubbed; common roots; fine tubular pores; abrupt smooth boundary.

A12b—11 to 15 inches (28–38 cm); dark reddish brown (5YR 3/3) silt loam; weak very thin platy structure; smeary when rubbed; few roots; clear smooth boundary.

B21—15 to 20 inches (38–50 cm); dark brown (10YR 3/3) silt loam; weak very thin platy structure; smeary when rubbed; few roots; clear smooth boundary.

B22—20 to 26 inches (50–66 cm); dark reddish brown (5YR 3/4) fine silt loam; weak very thin platy structure; smeary when rubbed; sticky, plastic; few roots; abrupt smooth boundary.

IIC1—26 to 32½ inches (66–83 cm); dark olive gray (5Y 3/2) gravelly sandy loam; massive; very friable; no roots.

In 1912 a thick layer of fresh volcanic ash was deposited on the northern part of the Kodiak Island group. The original features of the ash deposit are still preserved in the soil, although the ash has now settled to slightly more than half of its original thickness. The soil that developed in earlier ash deposits underlies the fresh ash.

Pedon *42*, Dystric Cryandepts, loamy (Kodiak series). About 2 miles (3 km) south of head of Anton Larsen Bay, Kodiak Island (*54*).

O11—4 to 1 inch (10–2 cm); litter of straw and alder leaves.

O12—1 inch to 0 (2–0 cm); dark brown (10YR 3/3) mat of partly decomposed organic material; extremely acid; abrupt smooth boundary.

C1—0 to 2 inches (0–5 cm); volcanic ash consisting of light gray (10YR 7/1) coarse silt loam; very weak thin platy structure; firm in place but friable when disturbed; few fine roots; very strongly acid; abrupt smooth boundary.

C2—2 to 6 inches (5–15 cm); volcanic ash consisting of light yellowish brown (10YR 6/4) coarse silt loam; massive; firm in place but friable when disturbed; few roots; very strongly acid; abrupt smooth boundary.

C3—6 to 8 inches (15–20 cm); volcanic ash consisting of light yellowish brown (10YR 6/4) loamy fine sand; single

grain; loose in place; few roots; strongly acid; clear wavy boundary.

C4—8 to 11 inches (20–28 cm); volcanic ash consisting of grayish brown (10YR 5/2) fine sand; single grain; loose in place; few roots; strongly acid; abrupt smooth boundary.

A11b—11 to 15 inches (28–38 cm); dark reddish brown (5YR 2/2) silt loam; weak, fine, subangular blocky structure; friable; streak of dark grayish brown (10YR 4/2) silt loam in center of horizon; many roots; extremely acid; abrupt wavy boundary.

A12b—15 to 23 inches (38–58 cm); dark reddish brown (5YR 3/3) silt loam; weak to moderate medium subangular blocky structure; friable in place but gives up moisture and becomes slack and sticky when worked, sticky when wet; streaks of brown (7.5YR 4/2) silt loam throughout; fewer roots than in horizon above; very strongly acid; gradual boundary.

Bb—23 to 27 inches (58–68 cm); brown (7.5YR 4/2) gravelly silt loam; many angular fragments; abrupt wavy boundary.

IIC1—27+ inches (68+ cm); olive (5Y 4/3) gravelly sandy loam mottled with reddish brown (5YR 4/4); very strongly acid.

Dystric Lithic Cryandepts are Andepts that are less than 20 inches (50 cm) thick over bedrock, but are otherwise like the Dystric Cryandepts.

Pedon *43*, Dystric Lithic Cryandepts, very gravelly (Pyramid series). About 2½ miles (4 km) north of Nondalton.

O1—3 inches to 0 (8–0 cm); dark brown (7.5YR 3/2) partially decomposed mat of plant material; abrupt smooth boundary.

A1—0 to 4 inches (0–10 cm); very dusky red (2.5Y 2/2) silt loam; weak very fine granular structure; very friable; common roots; clear wavy boundary.

B21—4 to 6 inches (10–15 cm); dark reddish brown (5YR 2/2) silt loam; weak very fine granular structure; very friable, but smeary when rubbed; common roots; clear wavy boundary.

B22—6 to 10 inches (15–25 cm); dark reddish brown (5YR 3/3) silt loam; weak very fine granular structure; very friable; smeary when rubbed; common roots; clear wavy boundary.

B3—10 to 14 inches (25–35 cm); dark brown (7.5YR 3/2) gravelly silt loam; weak very fine granular structure; few roots; gradual boundary.

C1—14 to 19 inches (35–48 cm); dark brown (7.5YR 4/2) cobbly loam; massive; friable; few roots in the upper part; dark stains on cobblestones; coarse fragments increase with depth; gradual boundary.

R—19+ inches (48+ cm); shattered basalt.

Lithic Cryandepts are Andepts that are less than 20 inches (50 cm) thick over bedrock, but are otherwise like the Typic Cryandepts.

Pedon *44*, Lithic Cryandepts, very gravelly (unnamed series). About 10 miles (16 km) east of Iliamna.

O1—4 inches to 0 (10–0 cm); dark reddish brown (5YR 2/2) mat of organic matter and roots, with admixture of white volcanic ash; abrupt smooth boundary.

A11—0 to 5 inches (0–12 cm); black (5YR 2/1) silt loam; streaks and patches of dark reddish brown (5YR 2/2), very dark grayish brown (10YR 3/2), and very dark gray (10YR 3/1); weak very thin platy structure; very friable, smeary when rubbed; common roots; very strongly acid; clear wavy boundary.

A12—5 to 7 inches (12–18 cm); dark brown (7.5YR 3/2) silt loam; weak very thin platy structure; very friable, smeary when rubbed; few roots; very strongly acid; clear wavy boundary.

IIB21—7 to 15 inches (18–38 cm); dark brown (10YR 4/3) very stony loam; weak very fine subangular blocky structure; friable, slightly sticky, slightly plastic, slightly smeary; no roots; very strongly acid; clear wavy boundary.

IIB22—15 to 19 inches (33–48 cm); dark brown (10YR 3/3) very stony loam; massive; friable, slightly sticky; no roots; very strongly acid; abrupt wavy boundary.

R—19+ inches (48+ cm); basalt.

Aquepts

Aquepts are the wet Inceptisols. They occur in all parts of Alaska on nearly every kind of parent material, and are by far the most extensive soils in the State. South of the permafrost zone they are principally on flood plains, in depressions in uplands, and on slopes subject to seepage. In the interior and in arctic and western Alaska, they occupy positions ranging from flood plains to mountain slopes.

In forested areas of the state the vegetation is principally a forest dominated by black spruce, willows, dwarf birch, and some cottonwood and paper birch. In the Alaska Peninsula and Southwestern Islands Major Land Resource Area and in many places in the interior, the soils support sedges, grasses, and other plants adapted to wet conditions. In areas of alpine and arctic tundra, mosses, sedges, willows, and low shrubs are dominant.

Typic Cryaquepts are gray or olive gray soils with a high water table during most or all of the summer. They are generally strongly mottled. These soils have a wide variety of texture, but are never made up completely of sand or gravelly sand and are not stratified. They may have a substratum of gravelly sand below depths of 12 inches (30 cm). There are only thin accumulations of organic matter on the soil surface and only thin dark upper horizons in the mineral soil. There are no thick layers of volcanic ash within or at the surface of the soil. The soils have no permafrost, and occur only in southern Alaska.

Pedon *45*, Typic Cryaquepts, very gravelly (Kalifonsky series). About 11 miles (18 km) west of Talkeetna (*59*).

O1—4 inches to 0 (10–0 cm); dark reddish brown (5YR 2/2) mat of decomposing organic material; many roots; very strongly acid; abrupt smooth boundary.

A1—0 to 2 inches (0–5 cm); dark brown (7.5YR 3/2) silt loam; weak very fine granular structure; very friable; common roots; few fine black (10YR 2/1) concretions; strongly acid; abrupt wavy boundary.

B21—2 to 9 inches (5–22 cm); olive (5Y 4/3) silt loam; common medium distinct brown (10YR 4/3) mottles; massive; very friable; nonsticky, nonplastic; a few roots; strongly acid; clear wavy boundary.

B22—9 to 22 inches (22–52 cm); olive gray (5Y 5/2) silt loam; common medium distinct brown (7.5YR 4/4) mottles; a few streaks and patches of olive brown; massive; nonsticky, nonplastic; a few roots; strongly acid; clear smooth boundary.

IIC1—22 to 40 inches (55–100 cm); olive (5YR 4/3) very gravelly sand; single grain; loose; a few subrounded stones; strongly acid.

Aeric Cryaquepts have olive gray or olive brown base colors and are highly mottled. They are saturated for short periods early in summer, but the water table is fairly deep much of the time. In Alaska they occur principally in the interior, on foot slopes of hills and in loess deposited on outwash plains and high terraces. Although they have mean annual temperatures above freezing, some of the deep silty soils on foot slopes overlie deeply buried ice masses. When the surface vegetation is removed by fire or clearing, sufficient heat may penetrate to these depths to melt the ice

and cause surface pitting. The soils commonly support either a white spruce-birch or a black spruce forest.

Pedon *46*, Aeric Cryaquepts, loamy (Minto series). About 16 miles (26 km) east of Fairbanks (*50*).

O11—4 to 3 inches (10–8 cm); relatively unweathered mat of roots, moss, and forest litter; abrupt smooth boundary.

O12—3 inches to 0 (8–0 cm); dark reddish brown (5YR 2/2) mat of roots and partially decomposed organic material; many mycelia; extremely acid; abrupt smooth boundary.

A1—0 to 3 inches (0–8 cm); very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; very friable; many roots; charcoal particles throughout horizon, but more common near the surface; very strongly acid; clear wavy boundary.

B21—3 to 7 inches (8–18 cm); dark grayish brown (2.5Y 4/2) silt loam; many large distinct mottles of dark yellowish brown (10YR 4/4), and few dark streaks along old root channels near top of horizon; mottles have diffuse boundaries; weak medium subangular blocky structure, parting to weak very thin platy; many fine (2mm) spherical pellets of silt loam, which crush to same color as matrix; very friable; few roots; strongly acid; clear wavy boundary.

B22—7 to 15 inches (18–38 cm); grayish brown (2.5Y 4/2) silt loam; few medium faint mottles of olive brown (2.5Y 4/4); moderate very thin platy structure; very friable; few roots; slightly acid; gradual boundary.

C1—15 to 30 inches (38–75 cm); dark grayish brown (2.5Y 4/2) silt loam; many horizontal streaks of olive brown (2.5Y 4/4); moderate very thin platy structure; very friable; few roots; mildly alkaline. Many feet thick.

Aeric Humic Cryaquepts differ from Aeric Cryaquepts in having a fairly thick, dark upper horizon. They are very inextensive in Alaska and are known to occur only in the Cook Inlet-Susitna Lowland.

Pedon *47*, Aeric Humic Cryaquepts, loamy (Pincher series). About ½ mile (1 km) northwest of Sterling (*49*).

O1—2 inches to 0 (5–0 cm); very dark brown (10YR 2/2) organic material; black (N 2/) near the surface where burned; strongly acid; abrupt smooth boundary.

A1—0 to 5 inches (0–12 cm); very dark brown (10YR 2/2) silt loam; common medium faint mottles of dark yellowish brown (10YR 4/4) and patches of black (N 2/); weak fine subangular blocky structure; friable; common roots; strongly acid; generally clear wavy boundary, but where boundary coincides with old root channels it is irregular.

B—5 to 14 inches (12–35 cm); olive brown (2.5Y 4/4) silt loam; very dark grayish brown (2.5Y 3/2) irregular streaks toward bottom of horizon; weak coarse subangular blocky structure crushing to very fine granules; friable; common roots; medium acid; clear wavy boundary.

C1—14 to 19 inches (35–48 cm); olive gray (5Y 4/2) silt loam; few fine faint mottles of olive brown; massive; friable; few roots; vesicular; medium acid; abrupt smooth boundary.

IIC2—19 to 22 inches (48–55 cm); olive gray (5Y 4/2) loamy sand; single grain; loose; no roots; slightly acid; abrupt smooth boundary.

IIC3—22 to 30 inches (55–75 cm); layered olive gray (5Y 4/2) silt loam and sandy loam; common medium faint mottles of olive brown (2.5Y 4/4); silt loam is massive, firm, and vesicular; sandy loam is massive and friable; no roots; slightly acid.

Andic Cryaquepts formed either entirely or partially in volcanic material. They are commonly associated with Cryandepts, but some are in areas of the Cook Inlet-Susitna Lowland and the Kuskokwim Highlands that are dominated by Cryorthods. These soils have colors much like those of the Cryandepts but also have mottling and streaking indicative of poor drainage. Some, especially those on the northern Kodiak Island group, have fresh deposits of ash at or near the surface.

Pedon *48*, Andic Cryaquepts, loamy (Ugak series). Near Kalsin Bay, Kodiak Island (*54*).

O1—1½ inches to 0 (4–0 cm); dark brown (7.5YR 3/2) mat of partly decayed organic material; abrupt smooth boundary.

C1—0 to 6 inches (0–15 cm); volcanic ash consisting of light yellowish brown (10YR 6/4) coarse silt loam; mottles of yellowish red (5YR 5/6) and a few streaks of light gray (10YR 7/1); massive; firm in place; few roots; strongly acid.

C2—6 to 10 inches (15–25 cm); volcanic ash consisting of light brownish gray (10YR 6/2) loamy fine sand mottled with yellowish red (5YR 5/6); single grain; loose; few roots; strongly acid; abrupt smooth boundary.

O1b—10 to 11 inches (25–28 cm); dark brown (10YR 3/3) peaty mat of roots and leaves; very strongly acid; abrupt smooth boundary.

A11b—11 to 15 inches (28–38 cm); black (10YR 2/1) silt loam; too wet to observe structure; nonsticky; few coarse fragments; many roots; strongly acid.

A12b—15 to 19 inches (38–48 cm); dark brown (10YR 3/3) silt loam containing few angular coarse fragments; slightly sticky; medium acid.

C—19 to 32 inches (48–80 cm); olive (5Y 4/3) silt loam streaked with dark brown (10YR 3/3) and black (10YR 2/1) slightly sticky; strongly acid.

Histic Cryaquepts have thick accumulations of organic matter at the soil surface in a peaty mat above the mineral soil or mixed, at least in part, with the mineral soil. These soils are usually among the wettest of the Aquepts, with a high water table throughout the summer. They occur only in southern Alaska.

Pedon *49*, Histic Cryaquepts, loamy (Torpedo Lake series). About 8 miles (13 km) southeast of Willow (*57*).

O1—5 inches to 0 (12–0 cm); black (5YR 2/1) mat of decomposing twigs, leaves, grass, and moss; many mycelia; strongly acid; abrupt smooth boundary.

A11—0 to 8 inches (0–20 cm); dark reddish brown (5YR 2/2) mucky silt loam; weak very fine granular structure; nonsticky and nonplastic; many roots; few stones; strongly acid; clear smooth boundary.

A12—8 to 12 inches (20–30 cm); dark reddish brown (5YR 3/2) and dark grayish brown (10YR 3/2) silt loam; weak fine subangular blocky structure; slightly sticky and slightly plastic; many roots; few subrounded stones; strongly acid; abrupt smooth boundary.

IIBg—12 to 26 inches (30–65 cm); dark greenish gray (5GY 4/1) sandy clay loam; many coarse prominent mottles of yellowish brown; massive; very firm, sticky and plastic; very few decaying roots; contains few pebbles and stones below 16 inches (41 cm); strongly acid. Many feet thick.

Histic Pergelic Cryaquepts have thick accumulations of organic matter on the soil surface, commonly in the form of a mat of slightly or partially decomposed mosses, sedges, and associated plants. Because the mat is effective insulation against summer heat, the permafrost table in these soils is normally very shallow. The upper part of the soils that thaws each summer and refreezes during the winter, known as the active layer, is almost constantly saturated during the thaw period. Cryostatic pressures during the refreezing period, solifluction on slopes, and other frost processes results in mixing or churning of the soil material so that any textural layers in the soil are disrupted and pieces of the organic mat are displaced downward. A common phenomenon, especially in the arctic, is a layer of humus-rich material at the permafrost table, which

acts as a floor to the churning processes. In many places some of the organic material is imbedded in the upper few inches of the permafrost, indicating that the depth of thawing was greater at some time in the past.

The soil surface is commonly irregular, with many low mounds, solifluction lobes, and other evidences of soil movement. Polygons and other patterned ground features are evident almost everywhere in the arctic but are less common in the interior. Along the Bering Sea Coast, especially in the Yukon-Kuskokwim Delta, isolated irregular mounds ranging in height from 2 to 5 feet (10 to 150 cm) and in diameter from a few feet to 100 feet (30 m) are more common than polygons. Around lake basins or on other topographic breaks, the mounds may have coalesced to form a continuous low ridge.

Histic Pergelic Cryaquepts are very extensive in interior, arctic, and western Alaska, in both lowland and hilly areas. Texture ranges from very gravelly sand to clay, and parent material includes volcanic ash, alluvium, loess, lacustrine deposits, and weathered rock. The soils range from strongly acid to strongly alkaline or calcareous, depending on the nature of the parent material. Colors are generally gray or olive gray. Many of the soils are mottled, but others in the lowest and wettest positions have uniform colors.

In most areas the vegetation is primarily sedge tussocks, mosses, low shrubs, and other tundra plants. In forested areas of interior Alaska, many of these soils support a dense stand of stunted black spruce.

Very gravelly sands in this subgroup occur principally in depressions in stream terraces and in swales between old beach ridges.

Pedon *50*, Histic Pergelic Cryaquepts, very gravelly (unnamed series). In city of Kotzebue.

O11—15½ to 10 inches (39–25 cm); very dark brown (10YR 2/2) partially decomposed sedge peat; many roots; neutral; abrupt smooth boundary.

O12—10 to 2 inches (25–5 cm); black (10YR 2/1) partially decomposed peat; many roots; neutral; abrupt smooth boundary.

O2—2 inches to 0 (5–0 cm); very dark gray (10YR 3/1) finely divided peat; neutral; abrupt smooth boundary.

C1—0 to 2 inches (0–5 cm); dark gray (5Y 4/1) very gravelly loamy sand; weak fine granular structure; very friable; slightly calcareous; abrupt smooth boundary.

C2—2 to 24 inches (5–60 cm); very dark gray (5Y 3/1) and olive gray (5Y 5/2) stratified sand and gravel; thin coatings of carbonates on lower surfaces of pebbles; single grain; loose; slightly calcareous. Frozen below.

Soils with silty or loamy textures are most extensive. They formed in material weathered from fine-grained rocks and in alluvial and lacustrine deposits.

Pedon *51*, Histic Pergelic Cryaquepts, loamy (Kuskokwim series) about 30 miles (48 km) southeast of Point Hope (*31*).

O11—7 to 3 inches (18–8 cm); black (7.5YR 2/1, wet) to dark brown (10YR 4/3, squeezed) partially disintegrated, finely fibrous peat.

O12—3 inches to 0 (8–0 cm); very dark gray (10YR 3/1), wet) to dark brown (10YR 3/3, squeezed) partially disintegrated, finely fibrous peat, with inclusions of olive yellow (5Y 6/6) and olive brown (2.5Y 4/4) silty material; abrupt slightly wavy boundary.

B21g—0 to 1 inch (0–3 cm); dark gray (N 3/) silt loam, with common large distinct olive brown (2.5Y 4/4), light olive brown (2.5Y 5/4), and gray (N 5/) mottling or staining; nonsticky and nonplastic; few roots; clear slightly wavy boundary.

B22g—1 to 9 inches (3–23 cm); dark gray (N 4/) silt loam; massive, with tendency toward platiness; nonsticky and nonplastic; some small pebbles; abrupt smooth boundary. The lower 3 cm of this horizon has erratic streaks of olive brown (2.5Y 4/6–5/6) fine soft concretionary material intermixed with very dark grayish brown (2.5Y 3/2) partially disintegrated organic material.

C1f—9 to 11 inches (23–28 cm); frozen very dark gray (N 3/) silt loam with inclusions of partially disintegrated, finely fibrous, very dark grayish brown (10YR 3/2) organic material; some few small fragments; ice constitutes about 10 percent of volume; clear coarse boundary.

C2f—11 to 18 inches (28–46 cm); frozen dark gray (N 4/) silt loam with inclusions of dark brown (7.5YR 3/4) partially disintegrated, finely fibrous organic material; ice constitutes about 75 percent of volume.

Pedon *52*, Histic Pergelic Cryaquepts, loamy (Goldstream series). About 30 miles (48 km) southeast of Fairbanks (*58*).

O1—7 to 3 inches (18–8 cm); dark brown (7.5YR 3/2) mat of moss, roots, and decomposing organic matter; extremely acid; clear smooth boundary.

O2—3 inches to 0 (8–0 cm); black (5Y 2/2) very finely divided organic matter; a few coarse sedge leaves; very strongly acid; clear smooth boundary.

A1—0 to 4 inches (0–10 cm); black (5Y 2/2) silt loam; massive; friable; many roots; very strongly acid; abrupt wavy boundary.

B21g—4 to 11 inches (10–28 cm); dark gray (5Y 4/1) silt loam; common, medium, distinct brown (10YR 4/3) mottles that have a diffuse boundary; weak very thin platy structure; friable; a few roots; strongly acid; clear smooth boundary.

B22g—11 to 27 inches (28–68 cm); dark gray (5Y 4/1) silt loam that contains streaks of black (5Y 2/1); many coarse prominent dark reddish brown (5YR 3/3) mottles that have a diffuse boundary; weak very thin platy structure; friable; frozen below a depth of 17 inches (42 cm) late in summer; strongly acid.

Many of the soils that developed on weathered rock and glacial moraines contain pebbles and cobbles.

Pedon *53*, Histic Pergelic Cryaquepts, very gravelly (Ester series). About 30 miles (48 km) northwest of Delta Junction.

O11—12 to 6 inches (30–15 cm); raw sphagnum moss; clear smooth boundary.

O12—6 inches to 0 (15–0 cm); yellowish brown (10YR 5/4) partially decomposed sphagnum moss; many twigs, leaves, and roots; extremely acid; abrupt smooth boundary.

A1—0 to 2 inches (0–5 cm); very dark grayish brown (10YR 3/2) silt loam, black (10YR 2/1) irregular streaks; weak thin platy structure; common roots; very strongly acid; clear wavy boundary.

B21gf—2 to 12 inches (5–30 cm); gray (5Y 4/1) silt loam; many very dark grayish brown (2.5Y 3/2) streaks; weak thin platy structure; frozen with clear ice lenses; few angular rock fragments; strongly acid; clear wavy boundary.

IIB22gf—12 to 16 inches (30–40 cm); very dark grayish brown (2.5Y 3/2) very gravelly silt loam; more than 60 percent by volume weathered schist fragments; frozen; medium acid; gradual boundary.

IIC3f—16 to 30 inches (40–75 cm); shattered schist.

Pedon *54*, Histic Pergelic Cryaquepts, loamy (Deborah series). About 12 miles (19 km) west of Paxson (*2*).

O11—9 to 3 inches (23–8 cm); raw sedges and hypnum moss peat; clear smooth boundary.

O12—3 inches to 0 (8–0 cm); black (5YR 2/1) partly decomposed sedge and moss peat; clear smooth boundary.

B21g—0 to 4 inches (0–10 cm); dark gray (5G 4/1) loam; common medium prominent dark yellowish brown (10YR 4/4) mottles; massive; friable, sticky and plastic;

few roots; a lens of pebbles, 2–5 cm in diameter, lies immediately below the O horizon and there are a few pebbles in the remainder of the horizons; pebbles are stained brown (10YR 4/3) on the upper surface and dark brown (7.5YR 3/2) on the lower surface; clear smooth boundary.

B22g—4 to 7 inches (10–18 cm); dark gray (5G 4/1) loam; few medium faint dark gray (5Y 4/1) mottles; massive; firm, sticky and plastic; few roots; few small pebbles about 1 cm in diameter; clear smooth boundary.

C1f—7 to 13 inches (18–33 cm); dark gray (5G 4/1) loam; few imbedded pebbles and cobbles; frozen with ice lenses up to 2 cm thick.

Some soils in the beds of old glacial lakes, as well as others formed in material weathered from fine-grained sedimentary rocks, are very clayey.

Pedon *55*, Histic Pergelic Cryaquepts, clayey (Klawasi series). About 5 miles (8 km) west of Glennallen (*2*).

O1—10 to 6 inches (25–15 cm); dark reddish brown (5YR 3/3) dry and dark reddish brown (5YR 2/2) moist raw hypnum moss peat; many roots; abrupt smooth boundary.

O2—6 inches to 0 (15–0 cm); black (N 2/) decomposed peat with few fibers after rubbing; abrupt wavy boundary with a few narrow tongues projecting into the C1g, some as far as the permafrost table.

B21g—0 to 13 inches (0–32 cm); dark gray (5Y 4/1) clay; few medium faint very dark gray (5Y 3/1) mottles; moderate very fine subangular blocky, breaking to weak thin platy structure; firm; very sticky, very plastic; few roots; abrupt smooth boundary.

C1f—13 to 33 inches (32–82 cm); dark gray (5Y 4/1) clay; frozen with many clear ice lenses; calcareous.

C2f—33 to 34 inches (82–85 cm); dark gray (5Y 4/1) irregular lens about 3 cm thick; may be organic; calcareous.

C3f—34 to 44 inches (85–110 cm); dark gray (5Y 4/1) loam; calcareous.

C4f—44 to 46 inches (110–115 cm); dark gray (5Y 4/1) silty clay loam; ends in a 3 cm thick ice lens; calcareous.

Soils developed in volcanic ash material may have dark acid mineral horizons below the organic mat.

Pedon *56*, Histic Pergelic Cryaquepts, loamy (Naknek series). About ½ mile (1 km) northwest of Naknek.

O11—16 to 9 inches (40–22 cm); dark reddish brown (5YR 3/3) to light reddish brown (5YR 6/3, squeezed dry) moss peat; many roots; extremely acid; abrupt smooth boundary.

O12—9 inches to 0 (22–0 cm); dark reddish brown (5YR 2/2 and 5YR 3/2) partially decomposed sedge peat; frozen at 2 inches; many roots; extremely acid; abrupt smooth boundary.

A1f—0 to 16 inches (0–40 cm) dark brown (7.5YR 3/2) loam (volcanic ash); many coarse distinct and prominent mottles of dark reddish brown (5YR 3/4) and gray (5GY 5/1); moderate very thin platy structure; few roots; extremely acid; abrupt wavy boundary. Frozen in late July.

Cgf—16 to 20 inches (40–50 cm); gray (5GY 5/1) loam; massive; medium acid; frozen.

Humic Cryaquepts have a thick, dark, acid horizon at the surface of the mineral soil but do not have a thick peaty mat above the mineral soil. In other respects, they are like the Typic Cryaquepts. They occur only in southern Alaska in flood plains, upland depressions, and seep areas. Most of the soils are forested, but some support only low shrubs, sedges, and grasses.

Pedon *57*, Humic Cryaquepts, loamy (unnamed series). About 1 mile (1.6 km) northwest of Dillingham.

O1—3 inches to 0 (8–0 cm); black (5Y 2/2) mat of plant parts, mosses, sedges, and roots; extremely acid; clear wavy boundary.

A1—0 to 6 inches (0–15 cm); streaked very dusky red (2.5YR 2/2) and black (5YR 2/1) silt loam; moderate very fine granular structure; friable; few fine black (10YR 2/1) concretions; common roots; extremely acid; clear wavy boundary.

B2g—6 to 36 inches (15–90 cm); patches and streaks of dark grayish brown (2.5Y 4/2) and dark reddish brown (5YR 3/4) silt loam; proportion of dark reddish brown decreases with depth; massive; nonsticky and nonplastic when wet; few roots; very strongly acid.

C1g—36 to 40 inches (90–100 cm); olive gray (5Y 4/2) silt loam; massive; nonsticky and nonplastic; very strongly acid.

Lithic Cryaquepts are less than 20 inches (50 cm) thick over hard, coherent bedrock, but are otherwise like the Typic Cryaquepts. These soils may have mean annual temperatures either above or below freezing.

Pergelic Cryaquepts have permafrost at some depth but do not have thick peaty accumulations on the surface. The depth of summer thaw in these soils is greater than in the Histic Pergelic Cryaquepts, and some have a permanently unfrozen zone between the bottom of the seasonally frozen soil and the permafrost table. This occurs particularly where the vegetative cover and any thin organic mat has been removed by fire or clearing.

Pergelic Cryaquepts have many characteristics in common with the Histic Pergelic Cryaquepts, but they normally have somewhat longer periods during which the soil is not completely saturated. Nearly all are strongly mottled. In interior Alaska they are mostly on alluvial plains, glacial moraines, or outcrops of coarse-grained rock, but in the arctic, where the rate of accumulation of organic matter is low, they occur in many positions and on a wider variety of parent material. Most of the soils in the arctic have patterned ground features. In many areas unvegetated frost scars or stone stripes are common.

On alluvial plains and low terraces in interior Alaska, the soils are commonly silty but may be stratified at some depth and may contain layers of gravelly material.

Pedon *58*, Pergelic Cryaquepts, loamy (Tanana series). About 4 miles (6 km) northwest of Fairbanks.

O1—5 inches to 0 (12–0 cm); very dark brown (10YR 2/2) mat of moss and roots; mycelia; abrupt smooth boundary.

A1—0 to 3 inches (0–8 cm); mixed very dark grayish brown (10YR 3/2) and dark gray (5Y 4/1) silt loam; few small charcoal particles; weak very thin platy structure, parting easily to weak very fine granules; friable; many roots; clear smooth boundary.

B21—3 to 11 inches (8–28 cm); dark gray (5Y 4/1) silt with many medium distinct mottles of dark brown; few small charcoal particles; weak very thin platy structure, parting to weak very fine subangular blocks; friable; nonsticky when wet; roots plentiful; clear smooth boundary.

B22—11 to 21 inches (28–52 cm); dark grayish brown (2.5Y 4/2) silt loam with common medium faint mottles of olive brown (2.5Y 4/4); weak very thin platy structure; friable; nonsticky when wet; few roots; gradual boundary.

C1—21 to 29 inches (52–72 cm); dark grayish brown (2.5Y 4/2) silt loam, slightly coarser than horizon above; weak very thin platy structure; very friable; nonsticky when wet; few roots; frozen below.

Stratified soils also occur in the beds of naturally drained lakes in arctic and western Alaska. These soils will, in time, accumulate enough peaty material on the surface to be classified as Histic Pergelic Cryaquepts.

Pedon *59*, Pergelic Cryaquepts, loamy (unnamed

series). About 1 mile (1.6 km) southwest of Bethel.

O11—2 inches to 1 inch (5–2 cm); undecomposed plant litter, hypnum moss, and roots; abrupt smooth boundary.
O12—1 inch to 0 (2–0 cm); dark brown (7.5YR 4/4) sedge peat; slightly decomposed; many roots; abrupt smooth boundary.
A1—1 inch to 1½ inches (0–4 cm); brown (10YR 4/3) silt loam; weak very thin granular structure; very friable; many roots; abrupt smooth boundary.
B21g—1½ to 12 inches (4–30 cm); dark brown (10YR 3/3) loamy fine sand; common large faint mottles of olive brown (2.5Y 4/4); very weak very thin platy structure; very friable; common roots; clear wavy boundary.
B22g—12 to 18 inches (30–45 cm); dark brown (10YR 3/3) loamy fine sand; common medium faint mottles of very dark grayish brown (10YR 3/2) weak very thin platy structure; very friable; few roots; abrupt smooth boundary.
C1f—18 to 23 inches (45–58 cm); olive gray (5Y 4/2) very fine sandy loam with thin lenses of silt loam; massive; nonsticky, nonplastic; few dead roots; frozen with clear ice lenses.

Soils on moraines are commonly gravelly throughout but may have an admixture of silty loessal material.

Pedon *60*, Pergelic Cryaquepts, very gravelly (Nome series). About 2 miles (3 km) north of Nome.

O1—3 inches to 0 (8–0 cm); dark reddish brown (5YR 2/2) partially decomposed mat of organic material; clear smooth boundary.
A1—0 to 2 inches (0–5 cm); dark reddish brown (5YR 3/2) gravelly silt loam; weak very fine granular structure; very friable; many roots; very strongly acid; clear smooth boundary.
B21g—2 to 6 inches (5–15 cm); dark gray (5Y 4/1) gravelly silt loam with patches and streaks of olive (5Y 4/3) and olive gray (5Y 4/2); weak fine granular structure; friable; common roots; very strongly acid; clear smooth boundary.
B22g—6 to 25 inches (15–62 cm); mixed olive (5Y 4/3) and dark gray (5Y 4/1) gravelly silt loam with horizontal streaks of olive gray (5Y 4/2); moderate medium platy structure; few roots; very strongly acid; clear smooth boundary.
C1f—25 to 36 inches (62–90 cm); mixed olive (5Y 4/3) and dark gray (5Y 4/1) coarse very gravelly silt loam with streaks of olive gray (5Y 4/2); moderate medium platy structure; friable; no roots; very strongly acid; frozen late in summer.

Pedon *60a*, Pergelic Cryaquepts, very gravelly (unnamed series). Ten miles (16 km) south of arctic coast near Canning River.

O1—1½ inches to 0 (4–0 cm); black (5YR 2/1) partially decomposed organic matter; abrupt smooth boundary.
B2g—0 to 14 inches (0–35 cm); dark gray (5Y 4/1) stratified fine sand and silt loam; strata are ½ to 2 inches (1 to 5 cm) thick; few discontinuous layers of organic matter; common medium distinct mottles of dark brown (10YR 4/3); very friable; calcareous; clear smooth boundary.
IIC—14 to 26 inches (35–65 cm); dark gray (5Y 4/1) very gravelly sand; single grain; loose; weakly calcareous.

Sandy soils of this subgroup occupy a large area in the arctic coastal plain.

Pedon *61*, Pergelic Cryaquepts, sandy (unnamed series). About 40 miles (64 km) south of Barrow.

O1—3 inches to 0 (8–0 cm); black (10YR 2/1) fibrous sedge peat; many roots; abrupt smooth boundary.
C1g—0 to 27 inches (0–68 cm); dark gray (5Y 4/1) loamy fine sand with thin strata of sand and sandy loam; common large distinct mottles of dark grayish brown (2.5Y 4/2); single grain; loose; few roots to 10 inches (25 cm), none below; neutral; frozen below 27 inches (69 cm) in midsummer.

In a large area of east central Alaska the upper mineral horizons consist of volcanic ash. The ash deposit, which has been in place for about 1,400 years, overlies the former peaty surface horizon.

Pedon *62*, Pergelic Cryaquepts, loamy (unnamed series). About 10 miles (16 km) north of Northway.

O1—2 inches to 0 (5–0 cm); black (5YR 2/1) mat of decomposing organic material; many roots; abrupt smooth boundary.
C1—0 to 2½ inches (0–6 cm); recent overburden; very dark gray (10YR 3/1) silt loam; weak fine granular structure; very friable; many roots; abrupt smooth boundary.
O2b—2½ to 4 inches (6–10 cm); black (5YR 2/1) finely divided organic matter; many roots; abrupt smooth boundary.
C2b—4 to 9 inches (10–22 cm); volcanic ash; light gray (10YR 7/1) coarse silt loam; massive; very friable; few roots; abrupt irregular boundary.
IIO2—9 to 10 inches (22–25 cm); black (5YR 2/1) organic matter; few roots; abrupt irregular boundary.
IIA1—10 to 12 inches (25–30 cm); mixed black (5YR 2/1) and very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure with tendency towards platiness; very friable; few roots; abrupt smooth boundary.
IIB2gf—12 to 20 inches (30–50 cm); dark grayish brown (2.5Y 4/2) silt loam; few fine distinct mottles of strong brown (7.5YR 5/6) and streaks of black (10YR 2/1) organic matter; degree of mottling increases with depth; weak thin platy structure; very friable; few roots. Frozen below 15 inches (38 cm) in midsummer.

Pergelic Ruptic-Histic Cryaquepts have been subjected to frost-stirring processes to the extent that much of the surface is barren or covered only with lichens and a few other pioneer tundra plants. Commonly these soils have polygonal surface patterns, and thick organic mats occur in the troughs between polygons. Pressures from expanding ice wedges beneath the troughs cause upwelling of mineral material in the centers of the polygons and resulting bare patches. In some places coarser particles have been displaced to the edges of raised polygon centers. On steeper gradients, pebbles and stones are concentrated in regularly spaced stripes running vertically down the slopes. The permafrost table is normally shallow under the organic mat in the troughs and in the space between stone stripes and is much deeper under the bare surfaces of the polygon centers and the stripes.

The proportion of the surface area occupied by bare frost scars ranges from 25 to 75 percent. These complex soils are more commonly fine-grained than sandy and are much more prevalent in arctic areas than in the interior of Alaska.

Pedon *63*, Pergelic Ruptic-Histic Cryaquepts, loamy (Kollutuk series). About 1½ miles (2½ km) south of village of Anaktuvuk Pass.

Part 1 (approximately 60 percent of pedon)—vegetated:

O1—9 to 6 inches (22–15 cm); dark reddish brown (5YR 2/2) coarse fibrous sedge peat; clear smooth boundary.
O2—6 inches to 0 (15–0 cm); black (5YR 2/1) finely divided peat; many roots; clear smooth boundary.
B21g—0 to 7 inches (0–18 cm); dark grayish brown (2.5Y 4/2) gravelly loam; many large distinct brown (7.5YR 4/4) mottles; massive; slightly sticky, slightly plastic; common roots; medium acid; abrupt wavy boundary.
B22g—7 to 13 inches (18–32 cm); dark gray (5Y 4/1) gravelly loam; common, large distinct very dark gray (N 3/) mottles; massive; slightly sticky, slightly plastic; medium acid; abrupt smooth boundary.

C1f—13 to 23 inches (32–58 cm); dark gray (5Y 4/1) gravelly loam; frozen; thick clear ice lenses; slightly acid.

Part 2 (approximately 40 percent of pedon)—nearly barren surface:

O1—1 inch to 0 (2–0 cm); black (5Y 2/1) fibrous organic matter; many roots; abrupt smooth boundary.

B1—0 to 7 inches (0–18 cm); brown (10YR 4/3) gravelly loam; weak very fine subangular blocky structure; friable; dead roots common; medium acid; abrupt wavy boundary.

B21g—7 to 12 inches (18–30 cm); brown (10YR 4/3) gravelly sandy loam; large dark gray (N 4/) mottles make up about 50 percent of the horizon; massive; firm; few dead roots; medium acid; clear wavy boundary.

B22g—12 to 36 inches (30–90 cm); dark gray (N 4/) gravelly loam; common large distinct brown (7.5YR 4/4) mottles; massive; firm; medium acid; abrupt smooth boundary.

C1gf—36 to 42 inches (90–106 cm); dark gray (N 4/) gravelly loam; common large distinct brown (7.5YR 4/4) mottles; frozen.

Ochrepts

Ochrepts are soils in which small or moderate amounts of organic matter have been incorporated into the upper few inches but not in sufficient quantity to permit recognition of an umbric or mollic epipedon. They have a brown cambic horizon. In some places the cambic horizon begins at the surface of the mineral soil. These soils occur principally in well drained forested sites in interior Alaska under a strongly continental climate with annual precipitation of 7 to 15 inches (18–38 cm). They also occur in areas above tree line in the interior and in sites with exceptionally good drainage characteristics in the arctic.

Below tree line the Ochrepts occur for the most part in the warmer sites, under a forest dominated by white spruce, paper birch, and quaking aspen. The sites include southerly slopes of low hills, ridgetops, and nearly level areas, such as outwash plains and terraces, where coarse permeable substrata do not permit retention of large amounts of water in the subsoil. In the Copper River Plateau and in areas just north of the Alaska Range, the soils are generally at elevations below 2,000 feet (600 m) and are dominant on slopes of all aspects except north. Forested Cryochrepts also occur on steep south-facing slopes at somewhat higher elevations. To the north, the maximum elevation decreases and the range in aspect narrows until, at the south face of the Brooks Range, they occur only at low elevations on steep slopes facing nearly directly south.

Typic Cryochrepts are nonacid and have high base saturation in some horizon between depths of 10 and 30 inches (25 and 75 cm); that is, the capacity of the soil to hold mineral elements is satisfied largely by such nutrient elements as calcium and magnesium rather than by hydrogen and aluminum. Most of these soils have silt loam or loam texture, but many are gravelly. Many are shallow over a substratum of sand or gravelly sand. Parent material includes loess and weathered or shattered bedrock.

Deep loessal soils border many of the large rivers of the interior. Commonly, there is a thin grayish brown horizon above the cambic horizon.

Pedon *64*, Typic Cryochrepts, loamy (Koyukuk series). About 2 miles (3 km) northeast of Manley Hot Springs.

O1—2 inches to 0 (5–0 cm); dark reddish brown (5YR 2/2) partially decomposed forest litter; many roots and mycelia; slightly acid; abrupt wavy boundary.

A2—0 to 2½ inches (0–6 cm); grayish brown (10YR 5/2) silt loam; dark reddish brown (5YR 3/3) coatings in old root channels; weak very fine subangular blocky structure; very friable; common roots; medium acid; abrupt irregular boundary.

B2—2½ to 7 inches (6–17 cm); dark yellowish brown (10YR 4/4) silt loam, containing tongues of A2 material; weak very thin platy structure, breaking to weak very fine subangular blocky; very friable; common roots; medium acid; clear wavy boundary.

B3—7 to 13 inches (17–32 cm); brown (10YR 4/3 and 5/3) silt loam; weak very thin platy structure; very friable; common roots; medium acid; many fine tubular pores in this and all horizons below; clear wavy boundary.

C1—13 to 27 inches (32–68 cm); brown (10YR 5/3 with horizontal streaks of 10YR 4/3) silt loam; weak very thin platy structure; very friable; few roots; slightly acid; clear wavy boundary.

C2—27 to 33 inches (68–84 cm); streaked dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) silt loam; weak very thin platy structure; very friable; few roots; slightly acid; gradual boundary.

C3—33 to 52 inches (84–129 cm); streaked dark grayish brown (2.5Y 4/2) and grayish brown (2.5Y 5/2) silt loam; few fine faint mottles of dark yellowish brown (10YR 4/4); weak very thin platy structure; very friable; few roots; neutral; gradual boundary.

C4—52 to 60 inches (129–150 cm); grayish brown (2.5Y 5/2) silt; dark yellowish brown (10YR 4/4) coatings in old root channels; weak very thin platy structure; very friable; no roots; neutral. The loess overlies shattered bedrock at 205 cm.

In areas distant from larger rivers or on steep slopes, the soils are very gravelly. These soils may be formed almost completely in weathered rock.

Pedon *65*, Typic Cryochrepts, very gravelly (Cheshnina series). About 4 miles (6 km) northeast of Kobuk.

O1—1½ inches to 0 (4–0 cm); black (5YR 2/1) partially decomposed organic matter; many roots; abrupt wavy boundary.

A1—0 to 1½ inches (0–4 cm); dark reddish brown (5YR 3/4) stony silt loam; weak fine granular structure; very friable; common roots; abrupt smooth boundary.

B2—1½ to 3½ inches (4–9 cm); dark yellowish brown (10YR 4/4) stony silt loam; weak fine granular structure; very friable; few roots; clear wavy boundary.

B3—3½ to 9 inches (9–22 cm); patchy olive brown (2.5Y 4/4) and dark yellowish brown (10YR 4/4) very stony silt loam; weak fine granular structure; very friable; few roots; gradual boundary.

C1—9 to 18 inches (22–45 cm); patchy dark grayish brown (2.5Y 4/2) and olive brown (2.5Y 4/4) very stony silt loam; massive; very friable; clear smooth boundary.

IIC2—18 to 30 inches (45–75 cm); shattered, partially weathered metamorphic rock.

Many of the Cryochrepts bordering the Yukon River formed in calcareous loess. Free lime has been leached from the upper part of the soil in the course of development of the brown horizon. In some of these soils, particularly on the Yukon Flats, small amounts of clay have migrated with percolating water into the brown B horizon. Not enough information is available at present to know if there has been enough accumulation of clay to make necessary a change in their classification. Some of these forested soils in the upper Yukon Valley and in areas farther north may have mean temperatures below freezing and, probably, perennially frozen strata at depths of 4 feet (120 cm) or more. Because of the difficulty of identifying such soils consistently in mapping, they are included with

the Typic Cryochrepts in this survey, though they are properly classified as Pergelic Cryochrepts.

Pedon *66*, Typic Cryochrepts, loamy (Rampart series). Nineteen miles (32 km) north of Fort Yukon.

O1—1 inch to 0 (3–0 cm); black (10YR 2/1) charred forest litter; many roots; slightly acid; abrupt wavy boundary.

A1—0 to 1 inch (0–3 cm); very dark grayish brown (10YR 4/3) silt loam; weak very fine granular structure; very friable; many roots; medium acid; abrupt wavy boundary.

A2—1 to 3½ inches (3–9 cm); brown (5YR 5/3) silt loam; weak very fine subangular blocky structure; very friable; common roots; medium acid; clear wavy boundary.

B2—3½ to 8 inches (9–19 cm); dark yellowish brown (10YR 4/4) silt loam; weak very fine subangular blocky structure; very friable; common roots; slightly acid; clear wavy boundary.

B3—8 to 12 inches (19–29 cm); brown (10YR 4/3) silt loam; weak very thin platy structure parting to weak very fine subangular blocky; very friable; common roots; neutral; abrupt wavy boundary.

C1—12 to 25 inches (29–63 cm); grayish brown (10YR 5/2) silt loam; weak very thin platy structure parting to weak very fine subangular blocky; very friable; few roots; calcareous; abrupt wavy boundary.

C2ca—25 to 28 inches (63–70 cm); dark grayish brown (10YR 4/2) silt loam; massive; very friable; few roots; strongly calcareous with many white lime flecks; abrupt wavy boundary.

C3—28 to 39 inches (70–97 cm); dark grayish brown (2.5Y 4/2) silt loam; massive; very friable; few roots; calcareous; abrupt irregular boundary.

C4—39 to 41 inches (97–103 cm); dark grayish brown (2.5Y 4/2) silt loam; many very dark gray (10YR 3/1) streaks and patches; massive; very friable; few roots; calcareous; abrupt irregular boundary.

C5—41 to 47 inches (103–118 cm); grayish brown (2.5Y 5/2) silt loam; few fine distinct mottles of dark brown (7.5YR 4/4); massive; very friable; few roots; calcareous; clear wavy boundary.

C6—47 to 58 inches (118–145 cm); grayish brown (2.5Y 5/2) silt loam; common medium distinct mottles of dark brown (7.5YR 4/4); massive; very friable; no roots; calcareous; abrupt smooth boundary.

C7f—58 to 68 inches (145–170 cm); same as horizon above; frozen.

The loess may be thin over outwash sand or gravel or glacial till. Soils of this kind are often dry in midsummer.

Pedon *67*, Typic Cryochrepts, very gravelly (Nenana series). About 7 miles (11 km) east of Delta Junction (*15*).

O1—2½ inches to 0 (6–0 cm); black (10YR 2/1) mat of charcoal and decomposing organic matter; severely burned; many fine roots and several large dead roots; abrupt smooth boundary.

A1—0 to 3 inches (0–8 cm); dark brown (10YR 3/3) micaceous silt loam; weak very fine subangular blocky parting to very thin plates when crushed; very friable; many fine roots and several large dead roots; charcoal fragments throughout horizon; clear wavy boundary.

A2—3 to 7 inches (8–18 cm); dark brown (10YR 4/3) micaceous silt loam; moderate very fine platy; very friable; many fine roots; many fine vesicles; contains charred black streaks and some charcoal fragments; clear wavy boundary.

B21—7 to 9 inches (18–22 cm); dark yellowish brown (10YR 4/4) micaceous silt loam with broad horizontal streaks and patches of dark brown (7/5YR 4/4); moderate very platy; very friable; fine roots; many fine vesicles; clear wavy boundary.

B22—9 to 13 inches (22–32 cm); dark yellowish brown (10YR 4/4) micaceous silt loam with streaks of brown (10YR 5/3); moderate very thin platy; very friable; common fine roots; many fine vesicles; clear wavy boundary.

BC—13 to 20 inches (32–50 cm); grayish brown (10YR 5/2) micaceous silt loam with common medium distinct mottles of dark yellowish brown (10YR 4/4) that appear as horizontal streaks; moderate very thin platy; very friable; common fine roots; many fine vesicles; clear wavy boundary.

IIC1—20 to 30 inches (50–75 cm); gravelly sand; single grain; loose; gravel rounded, almost entirely finer than 3 inches in diameter.

Alfic Cryochrepts have thin clayey bands, or lamellae, in the brown cambic horizon. The amount of clay is not large enough to permit recognition of an argillic horizon, but the bands indicate that clay is slowly accumulating in this horizon and that it eventually will be entirely clayey. Very thin bleached horizons, caused by lateral flow of water, commonly overlie each of the slowly permeable bands. Soils of this kind are known to occur only in parts of the Interior Highlands adjacent to the Tanana Valley, in noncalcareous micaceous loess that has been in place for thousands of years.

Pedon *68*, Alfic Cryochrepts, loamy (Fairbanks series). About 8 miles (13 km) southwest of Fairbanks (*15*).

O11—3 to 2 inches (8–5 cm); litter of undecomposed leaves, twigs, and other organic material.

O12—2 inches to 0 (5–0 cm); dark reddish brown (5YR 2/2) mat of decomposed fine and coarse organic material; many fine and coarse roots; mycelia common; abrupt wavy boundary.

A1—0 to 3 inches (0–8 cm); dark brown (10YR 4/3) micaceous silt loam; weak very fine crumb; very friable; many fine and coarse roots; clear wavy boundary.

A2—3 to 6 inches (8–15 cm); brown (10YR 5/3) micaceous silt loam; pale brown (10YR 6/3) on plate faces; moderate very thin platy; very friable; many fine roots; common fine vesicles; clear wavy boundary.

B2—6 to 15 inches (15–38 cm); dark yellowish brown (10YR 4/4) micaceous silt loam; yellowish brown (10YR 5/4) on plate faces; moderate very thin platy structure; very friable; many fine roots; common fine vesicles; abrupt wavy boundary. Within this horizon are thin bands of material designated as A'2 and B't which are described below. These bands were sampled separately from the B2. They are very numerous and fork and merge in an intricate pattern, but they are generally horizontal. They range from within 8 inches (20 cm) of the surface to as deep as 17 inches (43 cm) (within the B3) in places. Average depth is about 11 inches (28 cm).

A'2—½ inch thick. Pale brown (10YR 6/3) micaceous silt loam; brown (10YR 5/3) on plate faces; moderate very thin platy structure; very friable; many fine roots; common fine vesicles; abrupt wavy boundary. This horizon rests abruptly on and follows the wavy pattern characteristic of the B't.

B't—Averages ¼ inch thick, but is thinner where bands split and slightly thicker where the bands merge. Dark yellowish brown (10YR 4/4) micaceous silty clay loam with smooth ped faces that are lower in value (10YR 3/4); weak very fine subangular blocky structure; friable; many fine roots; common fine vesicles; abrupt wavy boundary.

B3—15 to 26 inches (38–65 cm); dark grayish brown (2.5Y 4/2) micaceous silt loam; moderate very thin platy; very friable; fine common roots; common fine vesicles; gradual wavy boundary. In places the bands of A'2 and B't dip slightly to depth of 17 inches (43 cm) into this horizon; these bands were not included in the sample.

C1—26 to 40 inches (65–100 cm); olive (5Y 4/3) micaceous silt with common moderate distinct dark yellowish brown (10YR 4/4) mottles; moderate very thin platy; very friable; few fine roots; common fine vesicles; gradual wavy boundary.

C2—40 to 52 inches (100–130 cm); olive (5Y 4/3) micaceous silt; weak medium platy; very friable; very few fine roots; common fine vesicles.

Andic Cryochrepts have a layer of silty volcanic ash

over soils like those of the Typic subgroup. These soils occur principally in east central Alaska just north of the Alaska Range and in adjoining parts of the Yukon Territory. The ash is believed to have originated in the Wrangell Mountains about 1,400 years ago.

Pedon *69*, Andic Cryochrepts, very gravelly (Ladue series). About 8 miles (13 km) north of Northway.

O1—1½ inches to 0 (4–0 cm); dark reddish brown (5YR 2/2) mat of organic material; many roots; fungal mycelia in lower part; abrupt smooth boundary.

A1—0 to 2½ inches (0–6 cm); volcanic ash; dark grayish brown (10YR 4/2) silt loam; streaks and patches of very dark brown (10YR 2/2); weak very thin platy structure; very friable; many roots; charcoal fragments; clear wavy boundary.

C1—2½ to 9 inches (6–22 cm); volcanic ash; gray (10YR 6/1) coarse silt loam; massive; very friable; few roots; abrupt irregular boundary.

IIA1—9 to 11 inches (22–28 cm); dark brown (10YR 4/3) silt loam; weak very thin platy structure, parting to weak very fine granular; very friable; common roots; few fine pebbles; clear smooth boundary.

IIB—11 to 16 inches (28–40 cm); dark brown (10YR 4/3 and 3/3) silt loam; moderate thin platy structure; very friable; few roots; few fine pebbles; clear wavy boundary.

IIIC1—16 to 23 inches (40–58 cm); reddish brown (2.5YR 5/4) gravelly silt loam; weak fine subangular blocky structure; friable; few roots; clear wavy boundary.

IIIC2—23 to 30 inches (58–75 cm); shattered schist.

Dystric Cryochrepts differ from soils in the Typic subgroup in that they are strongly acid and have less than 60 percent base saturation in the 10- to 30-inch (25 to 75 cm) section. These soils, however, have the same sequence of horizons as the Typic Cryochrepts. They are of limited extent in Alaska and are believed to occur only in areas with granitic bedrock.

Lithic Cryochrepts have hard bedrock within 20 inches (50 cm) of the surface. The soil above the bedrock may have characteristics of any of the other subgroups of Cryochrepts. Most are in areas above tree line.

Pedon *70*, Lithic Cryochrepts, very gravelly (unnamed series). About 2 miles (3 km) southeast of Chandalar airstrip.

O1—1½ inches to 0 (4–0 cm); very dark brown (10YR 2/2) mat of partially decomposed organic matter; many roots; abrupt smooth boundary.

A1—0 to 2 inches (0–5 cm); very dark grayish brown (10YR 3/2) very gravelly sandy loam; weak fine granular structure; nonsticky, nonplastic; micaceous; many roots; clear wavy boundary.

B—2 to 8 inches (5–20 cm); dark yellowish brown (10YR 4/4) and dark brown (10YR 4/3) very gravelly sandy loam; massive; nonsticky, nonplastic; micaceous; few roots; clear wavy boundary.

C—8 to 16 inches (20–40 cm); dark grayish brown (2.5Y 4/2) very gravelly sandy loam; massive; nonsticky, nonplastic; micaceous; few roots; strongly acid; abrupt wavy boundary.

R—16 to 18+ inches (40–45+ cm); partially weathered mica schist.

Pergelic Cryochrepts have mean annual temperatures below freezing, but in most of these soils the permafrost table is quite deep. They occur on ridges, escarpment edges, steep slopes, and other sites with good surface drainage in both alpine and arctic tundra areas. The soils are almost always gravelly. The native vegetation is primarily low shrubs, grasses, and associated tundra plants. In many places the vegetation is interrupted by patches of nearly bare soil. These scars are believed to be caused by frost action which loosens plant roots and allows the surface vegetation to be carried away by the wind. Other ground patterns resulting from frost action, including earth mounds, stone stripes, steps, and polygons, are common in areas of these soils.

Pedon *71*, Pergelic Cryochrepts, very gravelly (Soakpak series). About ½ mile (1 km) northeast of village of Anaktuvuk Pass.

O2—1 inch to 0 (2–0 cm); black (5YR 2/1) finely divided organic materials; many roots; abrupt smooth boundary.

A1—0 to ½ inch (0–1 cm); very dark brown (10YR 2/2) sandy loam; weak fine granular structure; very friable; many bleached sand grains; many roots; abrupt broken boundary.

B2—½ to 7 inches (1–18 cm); dark yellowish brown (10YR 4/4) gravelly sandy loam; weak very fine subangular blocky structure; friable; few roots; strongly acid; clear smooth boundary.

B3—7 to 11 inches (18–28 cm); brown (10YR 4/3) very gravelly sandy loam; weak very fine subangular blocky structure; friable; medium acid; clear wavy boundary.

IIC—11 to 28 inches (28–70 cm); olive (5Y 4/3) very gravelly sandy loam; weak fine subangular blocky structure; friable; calcareous.

Umbrepts

Umbrepts are well drained soils with umbric epipedons. They may or may not have a brown cambic horizon directly below the dark upper layer. These soils have their greatest extent in the Norton Sound Highlands and the southern part of the Kuskokwim Highlands, but they also occur in many other parts of Alaska. They are fairly common in alpine tundra areas in the interior and in well drained sites in the arctic and western tundra regions. Relatively few Umbrepts are in forested areas.

Typic Cryumbrepts have brown cambic horizons below the umbric epipedon and have mean annual temperatures above freezing. Typically, these soils support a low shrubby vegetation, but some are covered by a forest of white spruce and paper birch. These soils are most extensive on low hills north of the Yukon-Kuskokwim Delta.

Pedon *72*, Typic Cryumbrepts, very gravelly (unnamed series). About 15 miles (24 km) northeast of Pilot Station.

O11—5 to 2 inches (12–5 cm); dark reddish brown (5YR 2/2) forest litter; many roots; abrupt wavy boundary.

O12—2 inches to 0 (5–0 cm); black (5YR 2/1) partially decomposed organic matter; many roots; clear wavy boundary.

A1—0 to 4 inches (0–10 cm); dark brown (7.5YR 3/2) silt loam; weak very fine granular structure; very friable, slightly smeary when rubbed; many roots; strongly acid; clear wavy boundary.

B2—4 to 11 inches (10–28 cm); dark yellowish brown (10YR 3/4) gravelly silt loam; few patches of dark grayish brown (2.5Y 4/2) and very dark grayish brown (2.5Y 3/2); massive; very friable; common roots; strongly acid; clear wavy boundary.

C1—11 to 22 inches (28–55 cm); very dark grayish brown (2.5Y 3/2) very stony silt loam; patches of olive gray (5Y 4/2); massive; very friable; few roots; medium acid; increasingly stony below.

Entic Cryumbrepts have no cambic horizon below the umbric epipedon. They occur in areas where associated wet soils have a perennially frozen substratum, but they are free of permafrost. Most are forested. These soils are not extensive in Alaska.

Pedon *73*, Entic Cryumbrepts, very gravelly (unnamed series). About 3 miles (5 km) northeast of Aniak.

O1—3 inches to 1 inch (8–2 cm); dark brown (7.5YR 3/2) forest litter.
O2—1 inch to 0 (2–0 cm); black (10YR 2/1) finely divided organic matter; many roots; very strongly acid; abrupt smooth boundary.
A11—0 to 5 inches (0–12 cm); very dark grayish brown (10YR 3/2) silt loam; moderate very fine granular structure; very friable; common roots; few charcoal fragments; very strongly acid; clear wavy boundary.
A12—5 to 12 inches (12–30 cm); dark grayish brown (10YR 4/2) silt loam; weak fine subangular blocky structure; very friable; common roots; very strongly acid; clear wavy boundary.
C—12 to 24 inches (30–60 cm); brown (10YR 4/3) very shaly silt loam; few roots; very strongly acid.

Lithic Cryumbrepts have bedrock at depths of less than 20 inches (50 cm). Soil temperatures may be either above or below freezing, and the soils may or may not have a brown cambic horizon beneath the umbric epipedon. They occur in areas above tree line in south central, interior, and western Alaska, mostly under low shrubby vegetation.

Lithic Ruptic-Entic Cryumbrepts have hard bedrock at depths of less than 20 inches (50 cm). Soil temperatures may be either above or below freezing. The soil surface is hummocky with many unvegetated patches. Under the bare spots there is no umbric epipedon. The soils occur on high ridges above tree line and in tundra areas of western Alaska.

Pedon *74*, Lithic Ruptic-Entic Cryumbrepts, very gravelly (Aniak series). About 5 miles (8 km) north of Kobuk.

O1—1½ inches to 0 (4–0 cm); dark reddish brown (5YR 2/2) mat of decomposing organic material; abrupt broken boundary.
A11—0 to 1½ inches (0–4 cm); black (5YR 2/1) (60%) and very dark gray (5YR 3/1) (40%) silt loam; weak fine granular structure; very friable; many roots; about 10 percent gravel; very strongly acid; clear wavy boundary.
A12—1½ to 3 inches (4–8 cm); dark brown (7.5YR 3/2) stony silt loam; weak fine granular structure; very friable; many roots; very strongly acid; clear smooth boundary.
A13—3 to 7 inches (8–18 cm); dark brown (10YR 3/3) stony silt loam; weak fine granular structure; very friable; common roots; clear smooth boundary.
C—7 to 12 inches (18–30 cm); dark grayish brown (10YR 4/2) very stony silt loam; few roots; very strongly acid; gradual boundary.
R—12+ inches (30+ cm); fractured metamorphic bedrock.

Pergelic Cryumbrepts have mean annual temperatures below freezing. These are the most extensive of the Umbrepts in Alaska. They occur in positions with good surface drainage in areas above tree line in interior and western Alaska and are especially prevalant in the Norton Sound Highlands. They also exist in the arctic, but occupy only small areas with exceptionally good drainage conditions on ridgetops, escarpment edges, and steep slopes. The soils mostly, but not exclusively, formed in gravelly or sandy material. The vegetation is dominated by low shrubs, grasses, lichens and other tundra plants.

Pedon *75*, Pergelic Cryumbrepts, very gravelly (unnamed series). About 6 miles (10 km) south of Platinum (*45*).

O1—12 to 5 inches (5–2 cm); mat of loose litter and roots; not sampled.
O2—5 inches to 0 (2–0 cm); dark reddish-brown (5YR 2/2) decomposing organic matter; many roots; strongly acid; abrupt smooth boundary.
A11—0 to 3 inches (0–8 cm); dark brown (7.5YR 3/2) very gravelly silt loam; weak very fine granular structure; very friable, smeary when rubbed; many roots; very strongly acid; abrupt wavy boundary.
A12—3 to 6 inches (8–15 cm); dark brown (7.5YR 4/2) very gravelly silt loam; weak very fine granular structure; friable; common roots; very strongly acid; clear wavy boundary.
B—6 to 12 inches (15–30 cm); dark brown (10YR 4/3) very gravelly silt loam; weak very thin platy structure; friable; common roots; many fine tubular pores; dark brown (7.5YR 3/2) krotovinas up to 8 cm in diameter (avoided in sampling); very strongly acid; gradual boundary.
C1—12 to 20 inches (30–51 cm); brown (10YR 5/3) very gravelly silt loam; weak thin and medium platy structure, parting to very fine angular blocks; friable; few roots; strongly acid.
C2—20 to 28 inches (51–71 cm); brown (10YR 5/3) very gravelly silt loam; structure similar to that of horizon above; no roots; strongly acid.

Mollisols

Mollisols have a mollic epipedon but no underlying horizon dominated by ashy material. Their base saturation is more than 50 percent. In Alaska they occur principally in material derived from limestone or other basic rock, such as basalt.

In Alaska, most Mollisols are in tundra areas, but a few occur on calcareous or nonacid material in forested regions. They have a wide range in drainage conditions and texture.

Aquolls

Aquolls are the wet Mollisols. Below the dark upper mineral horizon they commonly have mottled gray or olive colors, but in the wettest positions the mottling may be absent. Most Aquolls in Alaska formed in material derived from calcareous rocks. The vegetation is dominantly sedges, low shrubs, and other tundra plants. In the interior, the soils also support black spruce and willows.

Typic Cryaquolls are the Aquolls with no thick mat of peaty organic matter on the surface but with mean annual temperatures above freezing. These soils are not known to occur in Alaska.

Pergelic Cryaquolls are perennially frozen at some depth. Most of the soils have a surface mat of peaty material, ranging in thickness from a few inches to more than 12 inches (30 cm). In many places, especially where the organic mat is thin, the mat is not continuous but is interrupted by patches in which the mineral soil is exposed. Pergelic Cryaquolls are common on calcareous material in the arctic and also occur in a few places in interior Alaska.

Pedon *76*, Pergelic Cryaquolls, very gravelly (unnamed series). About 10 miles (16 km) southwest of Noluck Lake.

O1—3 inches to 0 (8–0 cm); black (5YR 2/1) partially decomposed organic matter; many roots; neutral; abrupt smooth boundary.
A1—0 to 8 inches (0–20 cm); very dark gray (5YR 3/1) gravelly silt loam; common medium distinct mottles of dark yellowish brown (10YR 4/4); weak fine granular structure;

very friable; few roots; weakly calcareous; clear smooth boundary.

B2g—8 to 15 inches (20–38 cm); dark grayish brown (2.5Y 4/2) very gravelly silt loam; few common distinct mottles of dark yellowish brown (10YR 4/4); massive; friable; no roots; calcareous; abrupt smooth boundary.

C1gf—15 to 28 inches (38–70 cm); dark grayish brown (2.5Y 4/2) very gravelly silt loam; frozen late in summer.

Borolls

Borolls are well drained Mollisols, commonly formed in nonacid or calcareous material. They may have a brown cambic horizon below the mollic epipedon, but in some the epipedon rests directly on unaltered parent material. The greatest extent of Borolls is in tundra areas, but they also occur in forested areas.

Typic Cryoborolls have no permafrost and no calcareous material directly below the dark surface horizon. They may be calcareous at greater depths, however. These soils occur on forested terraces along the Copper and Chitina Rivers and on terraces and low hills bordering the Yukon Flats. Those on the hills north of the Yukon Flats may have mean temperatures below freezing. If the mean temperature were below freezing, the soils would be properly classified as Pergelic Cryoborolls. No temperature data are available.

Pedon *77*, Typic Cryoborolls, loamy (unnamed series). About 26 miles (42 km) west of Christian.

O1—3 inches to 0 (8–0 cm); very dark brown (10YR 2/2) partially decomposed organic matter; many roots; abrupt smooth boundary.

A11—0 to 6 inches (0–15 cm); dark brown (10YR 3/3) silt loam; weak fine subangular blocky structure; very friable; few roots; medium acid; abrupt smooth boundary.

A12—6 to 25 inches (15–62 cm); very dark grayish brown (10YR 3/2) silt loam; weak fine subangular blocky structure; very friable; no roots; medium acid; frozen below 25 inches in early summer.

Pergelic Cryoborolls are fairly extensive on limestone and carboniferous shales in the Arctic Foothills and on basaltic material in western Alaska. They generally are very gravelly and occupy positions with good surface drainage. Some have a cambic horizon below the dark surface horizon, but many do not. On limestone and carboniferous shales, the soils are commonly calcareous at all depths. On basalts, they are slightly acid. The vegetation is low shrubs, grasses, and other tundra plants. The permafrost table in these soils is deep.

Pedon *78*, Pergelic Cryoborolls, very gravelly (unnamed series). About 1 mile (1½ km) northeast of Tununak (*45*).

O1—4 to 2 inches (9–4 cm); mat of loose litter and roots; not sampled.

O2—2 inches to 0 (4–0 cm); black (5YR 2/1) finely divided organic matter; many roots; strongly acid; abrupt smooth boundary.

A11—0 to 2 inches (0–5 cm); dark reddish brown (5YR 2/2) gravelly mucky silt loam; weak very fine granular structure; very friable; many roots; strongly acid; abrupt smooth boundary.

A12—2 to 5 inches (5–13 cm); dark reddish brown (5YR 3/2) very gravelly loam; weak very fine granular structure; friable; plastic and slightly sticky when wet; common roots; medium acid; clear smooth boundary.

B—5 to 13 inches (13–33 cm); dark brown (7.5YR 3/2) very gravelly loam; weak fine granular structure; friable, plastic and sticky when wet; common roots; slightly acid; gradual boundary.

C—13 to 20 inches (33–51 cm); dark grayish brown (10YR 4/2) very gravelly loam; massive; friable, plastic and sticky when wet; common roots; slightly acid.

Lithic Ruptic-Entic Cryoborolls have hard bedrock at depths of 20 inches (50 cm) or less. Unvegetated frost scars with no soil horizonation make up a large part of the area of these soils. They are of small extent. All of them known to exist in Alaska have mean annual temperatures below freezing and support tundra vegetation.

Pedon *79*, Lithic Ruptic-Entic Cryoborolls, very gravelly (unnamed series). About 4 miles (6 km) northeast of Nome.

O1—½ inch to 0 (1–0 cm); mat of roots, lichens, and decomposing plant litter; abrupt smooth boundary.

A1—0 to 4 inches (0–10 cm); dark reddish brown (5YR 3/2) very flaggy silt loam; weak very fine crumb structure; very friable; many roots; clear smooth boundary.

B2—4 to 8 inches (10–20 cm); dark brown (10YR 3/3) very flaggy loam; weak very fine granular structure; very friable; few roots; calcareous; clear wavy boundary.

C1—8 to 19 inches (20–48 cm); olive (5Y 4/3) very flaggy loam; weak very fine granular structure; friable; no roots; calcareous; gradual boundary.

R—19+ inches (48+ cm); shattered marble bedrock.

Spodosols

In Spodosols organic carbon, aluminum, and, in most places, iron, have been leached by percolating water from the upper part of the soil and deposited or precipitated at greater depth to form a spodic horizon. Most Spodosols in Alaska have a surface mat of organic litter, which is at least partially decomposed, and a gray mineral horizon (an albic horizon) above the spodic horizon. Colors at the top of the spodic horizon are normally black or dark reddish brown, and those in lower parts are dark brown to yellowish brown. Except in sandy soil, the spodic horizon has thixotropic properties and becomes smeary when worked. Plowing, logging, or other disturbance has obscured the horizon sequence in some soils, but at least the lower part of the spodic horizon is normally visible. In a few soils, there is a thin black horizon in place of the albic horizon directly beneath the mat of organic material.

Spodosols are dominant on uplands in areas with high precipitation, where moisture in excess of that required by the natural vegetation moves completely through the soil. In general, the amounts of organic carbon, aluminum, and iron accumulated in the spodic horizon are directly related to precipitation rates, but they depend in part on characteristics of the parent material, ground water levels, and other factors. Except in very coarse material and in special situations in tundra areas, Spodosols in Alaska normally occur only where mean annual precipitation exceeds 15 inches.

Spodosols are most common in forested parts of the Southeastern Alaska, South Central Alaska Mountains, Cook Inlet-Susitna Lowland, and Kuskokwim Highlands Major Land Resource Areas, but also occur in areas above tree line and on very coarse parent material at lower elevations in the Interior Highlands. A few Spodosols occur in the arctic and western Alaska tundra areas.

Aquods

Aquods are the wet Spodosols. They occur in level areas with a fluctuating water table and on slopes affected by seepage. Some have a thick peaty mat on the soil surface, and many are mottled with various shades of red and brown in the upper part of the mineral soil. Some of the wettest soils are covered only with mosses, sedges, and low shrubs, but most of the soils are forested. Depending on the degree of wetness, the cover ranges from black spruce forest to forests much the same as those on the adjoining well drained soils. A few Aquods occur in tundra areas.

Typic Cryaquods occur mostly in areas that are subject to frequent fluctuations in the ground water level. A common position is at the edges of muskegs. These soils are generally sandy. They have a prominent bleached albic horizon over a spodic horizon in which organic carbon has accumulated to a much greater extent than iron. Commonly, at least part of this horizon is strongly cemented. Typic Cryaquods seldom occupy large contiguous areas but occur only in relatively small patches. They have been observed primarily in the Cook Inlet-Susitna Lowland. Soils of this subgroup have no permafrost.

Pedon *80*, Typic Cryaquods, sandy (Dinglishna series). About 22 miles (35 km) south of Willow (*59*).

O1—6 inches to 0 (15–0 cm); black (10YR 2/1) mat of partly decomposed moss, leaves, twigs, and other plant parts; many roots, very strongly acid; abrupt wavy boundary.

A2—0 to 6 inches (0–15 cm); gray (10YR 5/1) sandy loam; massive; friable; few roots; few pockets of silt loam; very strongly acid; abrupt wavy boundary.

B21—6 to 14 inches (15–35 cm); very dusky red (2.5YR 2/2) loamy sand; single grain; loose; many fine and medium hard concretions; very strongly acid; abrupt wavy boundary.

B22—14 to 20 inches (35–50 cm); very dusky red (2.5YR 2/2) sand; strongly cemented; very strongly acid; a few thin black (10YR 2/1) bands and streaks.

Lithic Cryaquods have hard bedrock at depths of less than 20 inches (50 cm). They are of very limited extent, and are known to occur only on slopes affected by seepage in southeastern Alaska.

Pedon *81*, Lithic Cryaquods, very gravelly (St. Nicholas series). About 10 miles (16 km) north of Hollis, Prince of Wales Island.

O11—5½ to 5 inches (14–12 cm); undecomposed forest litter.

O12—5 to 3 inches (12–8 cm); reddish black (10R 2/1) partially decomposed wet forest litter; many fine, medium and coarse roots; extremely acid (pH 4.0); clear wavy boundary.

O2—3 inches to 0 (8–0 cm), black (N 2/) muck; friable, nonsticky, nonplastic; many fine, medium, and coarse roots; extremely acid; clear wavy boundary.

A1—0 to ½ inch (0–1 cm); black (5YR 2/1) and dark reddish brown (5YR 2/2) very gravelly silt loam; weak fine granular structure; nonsticky, nonplastic; 60 percent gravel by volume; many fine, medium, and coarse roots; extremely acid; clear wavy boundary.

B2—½ inch to 14 inches (1–35 cm); dark reddish brown (5YR 3/3 and 5YR 2/2) very gravelly silt loam; weak medium to fine granular structure; nonsticky, nonplastic; 60 percent gravel by volume; many fine and common medium and coarse roots; many fine pores; very strongly acid; abrupt irregular boundary.

R—14+ inches (35+ cm); greenish graywacke.

Pergelic Sideric Cryaquods are the only Aquods known to occur in areas with permafrost. They occur in small depressions or on the edges of lakes and drainageways and are of very limited extent. The vegetation is generally mosses, sedges, and low shrubs, but in forested areas they may support paper birch.

Pedon *82*, Pergelic Sideric Cryaquods, loamy (unnamed series). About 2 miles (3 km) southwest of Bethel.

O1—1 inch to 0 (2–0 cm); mat of living polytrichum moss.

A2—0 to 2 inches (0–5 cm); grayish brown (10YR 5/2) silt loam; massive; friable; few roots; very strongly acid; clear wavy boundary.

B2—2 to 4 inches (5–10 cm); mixed dark reddish brown (2.5YR 2/4) and very dusky red (2.5YR 2/2) loamy very fine sand; weak very fine granular structure; friable; few roots; very strongly acid; abrupt irregular boundary.

B3—4 to 8 inches (10–20 cm); dark brown (7.5YR 3/2) fine sand; very weak very thin platy structure; friable; very strongly acid; clear wavy boundary.

C1—8 to 20 inches (20–50 cm); mixed very dark grayish brown (10YR 3/2), dark brown (7.5YR 4/4), and olive gray (5Y 5/2) stratified fine sand and silt loam with many medium distinct mottles of dark yellowish brown (10YR 4/4); massive; very friable; no roots; contains many smooth-walled vesicles; very strongly acid; frozen at 20 inches with clear ice lenses.

Sideric Cryaquods occupy shallow depressions in areas dominated by Typic Cryorthods, most commonly in the Cook Inlet-Susitna Lowland. They are normally loamy or silty, but some are in very coarse or clayey material. These soils generally have brown mottles in the albic horizon at the surface of the mineral soil, and in some places also have mottling in the spodic horizon and the underlying material. The water table is high during part of the growing season but may be 3 to 5 feet (90 to 150 cm) deep at other times. Black spruce is the dominant tree, but many of these soils also support white spruce and paper birch.

Pedon *83*, Sideric Cryaquods, loamy (Spenard series). About 12 miles (19 km) east of Anchor Point (*30*).

O11—7 to 4 inches (18–10 cm); raw sphagnum moss and hypnum moss.

O12—4 inches to 0 (10–0 cm); dark reddish brown (5YR 2/2) mat of partly decomposed organic matter and many roots over a thin layer of volcanic ash; abrupt smooth boundary.

A1—0 to 5 inches (0–12 cm); very dark grayish brown (2.5Y 3/2) silt loam; common medium distinct mottles of brown (10YR 4/3); massive; friable; common roots; black (10YR 2/1) streak near center of horizon; very strongly acid; clear wavy boundary.

B21—5 to 10 inches (12–25 cm); dark brown (7.5YR 3/2) silt loam; streaks and patches of dark reddish brown (5YR 3/3); massive; friable; few roots; few fine concretions; many pores; very strongly acid; clear wavy boundary.

B22—10 to 16 inches (25–40 cm); mixed brown and dark brown (10YR 4/3 and 7.5YR 4/4) silt loam; massive; friable, nonsticky and nonplastic; few roots; few very fine concretions; many pores; very strongly acid; clear smooth boundary.

B23—16 to 26 inches (40–65 cm); brown (10YR 4/3) silt loam; many coarse faint mottles of dark yellowish brown (10YR 4/4) and dark reddish brown (5YR 3/2); weak very thin platy structure; friable, nonsticky and nonplastic; very strongly acid; clear smooth boundary.

C1—26 to 31 inches (65–78 cm); olive (5Y 5/3) silt loam; massive; friable; very strongly acid; abrupt smooth boundary.

IIC2—31 to 40 inches (78–100 cm); olive (5Y 5/3) silt

loam; common coarse distinct mottles of dark reddish brown (5YR 3/4); massive; firm; few soft concretions; very strongly acid.

In places near large muskegs, especially where the soil has a gravelly or sandy substratum, a cemented layer has formed deep in the soil profile.

Pedon *84*, Sideric Cryaquods, loamy (Longmare series). About 2 miles (3 km) northwest of Kenai (*49*).

O11—4½ to 4 inches (11–10 cm); forest litter.
O12—4 inches to 0 (10–0 cm); dark reddish brown (5YR 3/2) mat of roots and decomposing parts of plants; very strongly acid; abrupt smooth boundary.
A2—0 to 2 inches (0–5 cm); grayish brown (10YR 5/2) silt loam; common medium faint mottles of dark grayish brown (10YR 4/2) and few fine distinct mottles of dark reddish brown (5YR 3/4); very weak very fine subangular blocky structure; friable; common roots; very strongly acid; abrupt irregular boundary.
B2—2 to 4 inches (5–10 cm); dark reddish brown (2.5YR 2/4 and 5YR 3/4) silt loam; weak fine subangular blocky structure; friable; common roots; strongly acid; clear irregular boundary.
B3—4 to 8 inches (10–20 cm); dark brown (10YR 3/3) silt loam; common medium faint brown (10YR 5/3) mottles; weak medium subangular blocky structure; friable; common roots; strongly acid; gradual boundary.
C1—8 to 21 inches (20–52 cm); dark grayish brown (2.5Y 4/2) to olive brown (2.5Y 4/4) silt loam; common medium prominent mottles of yellowish red (5YR 5/6) very weak medium subangular blocky structure parting to fine granules; friable; few roots; few pebbles; strongly acid; clear wavy boundary.
C2—21 to 29 inches (52–72 cm); silt loam in irregular streaks of dark grayish brown (10YR 4/2 and 2.5Y 4/2), dark yellowish brown (10YR 4/4), and very dark grayish brown (2.5Y 3/2); common small distinct mottles of yellowish red (5YR 5/6); massive; friable; nonsticky; few roots; medium acid; abrupt smooth boundary.
C3—29 to 32 inches (72–80 cm); strong brown (7.5YR 5/8) silt loam; streaks of dark grayish brown (2.5Y 4/2); massive; friable, nonsticky; very few roots; few pebbles; medium acid; abrupt smooth boundary.
IIC4—32 to 48 inches (80–120 cm); mixed dark reddish brown (2.5YR 2/4), yellowish red (5YR 5/8), and olive (5Y 4/3) sand; strongly cemented; no roots; medium acid; abrupt smooth boundary.
IIC5—48 to 54 inches (120–135 cm); mixed dark reddish brown (2.5YR 2/4), yellowish red (5YR 5/8), and olive 5Y 4/3) gravelly sand; strongly cemented; medium acid; abrupt smooth boundary.
IIC6—54 to 66 inches (135–165 cm); olive (5Y 4/3) stratified sand and gravel; pebbles rounded; single grain; loose; medium acid; many feet thick.

Cryic Fragiaquods are soils in areas with high annual rainfall. They are kept nearly constantly wet by seep water flowing over a fragipan formed in compact glacial till. The fragipan is very firm and very slowly permeable. These soils are extensive on moraines at low elevations in southeastern Alaska and in areas near the north coast of the Gulf of Alaska. They commonly support forests dominated by western hemlock.

Pedon *85*, Cryic Fragiaquods, very gravelly (Wadleigh series). About 25 miles (40 km) northwest of Juneau.

O1—8 to 3 inches (20–8 cm); dark reddish brown (5YR 2/2) partially decomposed forest litter; many roots; clear smooth boundary.
O2—3 inches to 0 (8–0 cm); black (5YR 2/1) finely divided organic matter; many roots; abrupt smooth boundary.
A2—0 to 3 inches (0–8 cm); grayish brown (10YR 5/2) gravelly silt loam; few fine prominent brown (7.5YR 4/4) mottles; very weak medium subangular blocky structure; friable; common roots; abrupt wavy boundary.
B21—3 to 5 inches (8–12 cm); dark reddish brown (5YR 2/2) very gravelly silt loam; moderate fine granular structure; very friable; few soft fine concretions; few weakly cemented fragments; smeary when rubbed; common roots; very strongly acid; clear irregular boundary.
B22—5 to 10 inches (12–25 cm); dark brown (7.5YR 3/2) very gravelly sandy loam; weak fine subangular blocky structure; friable; slightly smeary; common roots; very strongly acid; clear wavy boundary.
B23—10 to 16 inches (25–40 cm); dark yellowish brown (10YR 3/4) very gravelly sandy loam; very weak medium subangular blocky structure; friable; common roots; very strongly acid; clear smooth boundary.
B3x—16 to 23 inches (40–58 cm); olive brown (2.5Y 4/4) very gravelly sandy loam; few fine prominent strong brown (7.5YR 5/6) mottles and many streaks of dark brown (10YR 4/3); weak medium platy structure; weakly cemented; slightly brittle; clear smooth boundary.
C1x—23 to 30 inches (58–75 cm); patchy olive gray (5Y 4/2) and dark grayish brown (2.5Y 4/2) very gravelly sandy loam; few medium distinct olive brown (2.5Y 4/4) mottles; very weak medium platy structure; weakly cemented; slightly brittle; clear smooth boundary.
C2—30 to 60 inches (75–150 cm); olive gray (5Y 4/2) very gravelly loam; few medium faint dark gray (5Y 4/1) mottles; massive; slightly sticky, slightly plastic; very strongly acid.

Placic Haplaquods are very wet soils that contain a placic horizon which is impermeable to water. They are inextensive and occur only in small patches in southeastern Alaska, commonly surrounded by Cryic Fragiaquods or shallow Histosols. The vegetation is forest dominated by western hemlock.

Pedon *86*, Placic Haplaquods, very gravelly (Shinaku series). About 11 miles (18 km) southwest of Hollis, Prince of Wales Island.

O1—8 to 6 inches (20–15 cm); litter of living mosses with twigs, roots, and stems.
O21—6 to 1½ inches (15–4 cm); dark reddish brown (5YR 2/2) moderately well decomposed organic matter; abundant fine and very fine common medium and few coarse roots; extremely acid; clear smooth boundary.
O22—1½ inches to 0 (4–0 cm); dark reddish brown (5YR 3/2) well decomposed organic matter; common fine and very fine and few medium roots; extremely acid; abrupt wavy boundary.
A2—0 to 2 inches (0–5 cm); light gray (10YR 7/2) and grayish brown (10YR 5/2) silt loam; weak fine subangular blocky structure; friable; 5 percent gravel; few fine and very fine roots; extremely acid; abrupt wavy boundary.
B21h—2 to 4 inches (5–10 cm); dark reddish brown (5YR 2/2) and very dark brown (10YR 2/2) gravelly silty clay loam; weak fine subangular blocky structure; slightly sticky; 20 percent gravel; few fine roots; extremely acid; clear wavy boundary.
B22h—4 to 10 inches (10–25 cm); black (5YR 2/1) dark brown (10YR 4/3) and very dark grayish brown (10YR 3/2) gravelly sandy loam; weak medium subangular blocky structure; friable; 35 percent gravel; extremely acid; clear wavy boundary.
B3—10 to 13 inches (25–32 cm); dark grayish brown (10YR 4/2) and dark reddish brown (5YR 3/3) very gravelly sandy loam with dark reddish brown (5YR 3/2) organic stains; moderate medium platy structure; firm; 50 percent gravel and cobbles; medium acid; abrupt wavy boundary.
B'2irm—13 to 13½ inches (32–34 cm); dark reddish brown (2.5YR 3/4) and very dusky red (2.5YR 2/2) ironpan; cemented very strongly; 40 percent gravel; extremely acid; abrupt wavy boundary.
C1x—13½ to 26 inches (34–65 cm); strong brown (7.5YR 5/6) and olive gray (5Y 4/2) stony coarse sand; massive; very firm; 65 percent gravel, cobbles, and stones; slightly acid; gradual wavy boundary.
C2x—26 to 47 inches (65–118 cm); olive gray (5Y 5/2) stony sand with reddish yellow (7.5YR 6/8) and yellowish

red (5YR 4/6) following rock faces; massive; very firm; 75 percent gravel, cobbles, and stones; medium acid.

Humods

Humods are well drained Spodosols that have large accumulations of organic carbon relative to iron in at least part of the spodic horizon. In most Humods, the upper part of the spodic horizon is black or nearly black. Lower parts of the horizon range from dark reddish brown to brown or yellowish brown. The entire horizon invariably has strongly thixotropic properties.

In Alaska, these soils develop mostly in ashy material. They occur primarily in an area surrounding Mt. Edgecumbe in southeastern Alaska and in parts of the Cook Inlet-Susitna Lowland and the Kuskokwim Highlands that are covered by ash from active volcanoes in the Aleutian Range. Most Humods are forested, but some of them support vegetation dominated by tall grass and alder.

Typic Cryohumods have high organic matter concentrations in the upper part of the spodic horizon. They range in apparent texture from silt loam to sandy loam, but all have strongly thixotropic properties in the subsoil. Many of the soils are deep, but some have a shallow substratum of nonashy material. The vegetation is either a Sitka spruce-western hemlock or a white spruce-paper birch forest, or tall grass, alder, and associated plants. It is likely that many of these soils in the Cook Inlet-Susitna Lowland and the southern part of the Kuskokwim Highlands were Andepts in an earlier stage of their history, but in southeastern Alaska spodic horizons probably developed very soon after deposition of the volcanic ash parent material. Because it is not possible to distinguish Typic Cryohumods from Humic Cryorthods without chemical analyses, those in the Cook Inlet-Susitna Lowland and the Kuskokwim Highlands, where both subgroups are represented, were all mapped as Humic Cryorthods.

Pedon *87*, Typic Cryohumods, very gravelly (Nondalton series). Directly north of Nondalton (*47*).

O1—4 inches to 0 (10–0 cm); very dusky red (2.5YR 2/2) partially decomposed organic material; many roots; charcoal; abrupt smooth boundary.

A2—0 to 2 inches (0–5 cm); dark gray (10YR 4/1) silt loam; pockets of dark brown (10YR 4/3) fine sand, probably ash, and irregular streaks of very dusky red (2.5YR 2/2) mucky silt loam; weak very thin platy structure; friable, slightly smeary when rubbed; many roots; charcoal; mycelia; abrupt irregular boundary.

B21—2 to 5 inches (5–12 cm); reddish black (10YR 2/1) silt loam; moderate very fine granular structure; brittle at upper surface of horizon and fine concretions throughout, but generally friable; common roots; mycelia; clear irregular boundary.

B22—5 to 9 inches (12–22 cm); dark reddish brown (2.5YR 3/4) coarse silt loam; weak very fine granular structure; friable, slightly smeary when rubbed; common roots; mycelia; clear wavy boundary.

B3—9 to 13 inches (22–32 cm); dark brown (7.5YR 4/4) coarse silt loam; weak very thin platy structure; friable, slightly smeary when rubbed; common roots; abrupt wavy boundary.

IIC1—13 to 23 inches (32–57 cm); olive (5Y 4/3) gravelly sandy loam; lenses of dark brown (10YR 4/3) gravelly sandy loam and yellowish brown (10YR 5/6) silt loam near upper surface of horizon; weak fine platy structure; very friable; no roots.

Lithic Cryohumods have bedrock within 20 inches (50 cm) of the soil surface, but in other respects are like the Typic subgroup.

Pedon *88*, Lithic Cryohumods, loamy (unnamed series). Near Nuyakuk Lake, about 63 miles (110 km) north of Dillingham.

O1—3 inches to 0 (8–0 cm); dark reddish brown (5YR 3/3) mat of organic material; many roots; abrupt smooth boundary.

A2—0 to 1 inch (0–3 cm); dark brown (10YR 4/3) silt loam; weak very fine crumb structure; very friable; many roots; abrupt wavy boundary.

A11—1 to 4 inches (3–10 cm); very dusky red (2.5YR 2/2) mucky silt loam; weak fine platy structure; very friable, smeary; many roots; clear wavy boundary.

A12—4 to 6½ inches (10–16 cm); dark reddish brown (2.5YR 2/4) silt loam; weak very fine subangular blocky structure; very friable, smeary; many roots; clear wavy boundary.

A13—6½ to 10 inches (16–25 cm); dark reddish brown (5YR 3/4) silt loam; intermittent streak of dark brown (7.5YR 3/2) at base of horizon; weak very thin platy structure; very friable, smeary; many roots; abrupt wavy boundary.

A1b—10 to 15 inches (25–38 cm); dark reddish brown (5YR 2/2) silt loam; weak thin platy structure; very friable, smeary; common roots; many fine vesicles; clear wavy boundary.

Cb—15 to 18 inches (38–46 cm); dark reddish brown (5YR 3/4) silt loam; moderate thin platy structure; very friable, smeary; few roots; vesicular; soil in contact with rock below is stained dark reddish brown (5YR 2/2); abrupt wavy boundary.

R—18+ inches (46+ cm); hard bedrock.

In southeastern Alaska, Lithic Cryohumods have formed under alpine tundra vegetation.

Pedon *89*, Lithic Cryohumods, loamy (Kadin series). About 4 miles (6 km) west of head of Totem Bay, Kupreanof Island.

O11—2 inches to 1 inch (5–2 cm); mosses and undecomposed litter.

O12—1 inch to 0 (2–0 cm); very dusky red (2.5YR 2/2) partially decomposed plant litter; many fine and medium, and few coarse roots; extremely acid; abrupt smooth boundary.

A2—0 to 2 inches (0–5 cm); grayish brown (10YR 5/2) silt loam; weak fine granular structure; friable, nonsticky and slightly plastic; 5 percent coarse fragments by volume; common fine and medium and few coarse roots; very strongly acid; abrupt smooth boundary.

B21—2 to 5 inches (5–12 cm); dark reddish brown (5YR 2/2) mucky sandy loam; weak fine granular structure; friable, smeary; 10 percent coarse fragments by volume; few fine, medium, and coarse roots; very strongly acid; clear wavy boundary.

B22—5 to 6 inches (12–15 cm); reddish brown (2.5YR 5/4) loam; dark reddish brown (5YR 2/2) and black (10YR 2/1) patches; weak fine granular structure; very friable; very strongly acid; abrupt wavy boundary.

R—6+ inches (15+ cm); volcanic tuff.

Cryic Placohumods have a thin, very hard placic horizon within the spodic horizon. The placic horizon develops only in soils formed in volcanic ash in areas with very high rainfall. Apart from the placic horizon, the soils are like the Typic Cryohumods and support a forest of western hemlock and Sitka spruce.

Pedon *90*, Cryic Placohumods, loamy (Kruzof series). Kruzof Island.

O1—10 to 3 inches (25–8 cm); reddish black (10YR 2/1) partially decomposed forest litter; thin ash lenses; many roots; abrupt wavy boundary.

O2—3 inches to 0 (8–0 cm); reddish black (10YR 2/1) and very dusky red (10YR 2/2) muck; many roots; abrupt wavy boundary.

A2—0 to 2 inches (0–5 cm); gray (10YR 5/1) very fine sandy loam; very weak thin platy structure, parting to very fine subangular blocky, very friable, nonsticky and

nonplastic; few roots; very thin layer of reddish yellow (7.5YR 6/6) silty volcanic ash at top of horizon; abrupt irregular boundary.

A3—2 to 3 inches (5–8 cm) very dark gray (10YR 3/1) and dark grayish brown (10YR 4/2) silt loam; weak fine subangular blocky structure; friable but releases moisture and becomes smeary when rubbed, slightly plastic; few roots; abrupt broken boundary.

B21h—3 to 8 inches (8–20 cm); black (5YR 2/1) mucky silt loam; weak coarse prismatic structure with thin shiny coatings on peds; smeary when rubbed; slightly sticky, slightly plastic; few roots; abrupt irregular boundary, with some narrow tongues extending to 32 inches (81 cm).

B22h—8 to 12 inches (20–30 cm); yellowish red (5YR 5/6) sandy loam; weak coarse prismatic structure, with dark reddish brown (5YR 3/4) coatings on peds; few vertical cracks coated with dark reddish brown (2.5YR 2/4) and black (N 2/); smeary when rubbed; sticky, plastic; no roots; few firm gray (5YR 5/1) patches at base of horizon; abrupt broken boundary.

B23irm—12 to 13 inches (30–33 cm); dark reddish brown (2.5YR 3/4) silt loam; moderate fine to medium angular blocky structure; interiors of peds, which are weathered pumice fragments, are red (2.5YR 4/6); irregular seams of dark reddish brown (2.5YR 2/4); very firm in place, but becomes friable and smeary when rubbed; sticky, plastic; no roots; horizon is roughly horizontal, but is convoluted.

B31—13 to 22 inches (33–56 cm); strong brown (7.5YR 5/6) and yellowish red (5YR 4/6) silt loam; massive, but the soil consists of highly weathered pumice particles with yellow (10YR 7/8) interiors that make up about 30 percent of the horizon; irregular dark reddish brown (2.5YR 3/4) streaks; smeary when rubbed; sticky, plastic; no roots; gradual boundary.

B32—22 to 36 inches (56–91 cm); same as horizon above, except that yellow (10YR 7/8) pumice interiors make up about 50 percent of the horizon.

B33—36 to 75 inches (91–185 cm); same as above, but sampled separately.

C—75 to 90 inches (185–229 cm); yellow (10YR 7/8) slightly weathered pumice of fine gravel size.

Orthods

Orthods are well drained Spodosols in which organic carbon, aluminum, and iron are all present in significant quantities throughout the spodic horizon. Organic carbon concentration may be as high as in the Humods, but the ratio between carbon and iron is narrower. These soils occur under a western hemlock-Sitka spruce forest in Southeastern Alaska, under a white spruce-paper birch forest in the Cook Inlet-Susitna Lowland, the Kuskokwim Highlands, and parts of the Norton Sound Highlands, and under tundra vegetation in areas above tree line in interior and south central Alaska and in a few places in the Arctic Foothills.

Typic Cryorthods have moderate accumulations of organic carbon in the spodic horizon and have no permafrost. These soils generally have a thin albic horizon below the organic mat and a dark reddish brown to dark yellowish brown spodic horizon. The bottom of the spodic horizon is seldom more than 20 inches (50 cm) deep. The soils formed in a variety of parent material ranging from very gravelly sand to loam or silt loam, but they seldom form in clayey material with slow permeability. In Alaska, the parent material of many Typic Cryorthods is silty loess or a mixture of loess and volcanic ash of varying thickness over a substratum that ranges from outwash gravel to compact till.

Pedon *91*, Typic Cryorthods, loamy (Soldatna series). About 7 miles (11 km) northwest of Kenai (*49*).

O11—4 to 3 inches (10–8 cm); litter of leaves, needles, and twigs; abrupt smooth boundary.

O12—3 inches to 0 (8–0 cm); dark reddish brown (5YR 2/2) mat of roots, decaying leaves, and moss; mycelia; very strongly acid; abrupt smooth boundary.

A2—0 to 3 inches (0–8 cm); gray (5Y 5/1) silt loam; few fine faint mottles of brown (10YR 5/4) in lower part of horizon; weak very fine subangular blocky structure; friable; common roots; charcoal particles; very strongly acid; abrupt irregular boundary.

B21—3 to 6 inches (8–15 cm); dark reddish brown (5YR 3/4) silt loam; patches of brown (7.5YR 4/4); weak fine to medium subangular blocky structure; friable; common roots; some mycelia; strongly acid; clear wavy boundary.

B22—6 to 10 inches (15–25 cm); brown (7.5YR 4/4) silt loam; pockets of grayish brown; weak fine to medium subangular blocky structure; friable; common roots; medium acid; clear wavy boundary.

B3—10 to 18 inches (25–45 cm); olive brown (2.5Y 4/4) silt loam; very weak medium subangular blocky structure; friable; few roots; few (about 5 percent) rounded pebbles up to 3 inches in diameter; medium acid; gradual boundary.

C1—18 to 25 inches (45–62 cm); olive (5Y 4/3) silt loam; common coarse faint mottles of olive brown; few yellowish brown streaks at bottom of horizon; massive; friable; a few rounded pebbles, as in horizon above; few roots; medium acid; abrupt wavy boundary.

IIC2—25 to 42 inches (62–105 cm); olive (5Y 4/3) gravelly sand; single grain; loose; massive lenses of silt loam; dark red (2.5YR 3/4) mottles in silt loam lenses; no roots; medium acid; clear broken boundary.

IIC3—42 to 50 inches (105–125 cm); olive (5Y 4/3) gravelly sand; single grain; loose; pebbles rounded; slightly acid; many feet thick.

Pedon *92*, Typic Cryorthods, loamy (Kenai series). About 2 miles (3 km) northeast of Soldotna (*51*).

O11—2½ to 2 inches (6–5 cm); forest litter.

O12—2 inches to 0 (5–0 cm); dark reddish brown (5YR 2/2) mat of decomposing organic material; many coarse and fine roots; fungal mycelia; few very thin lenses of white sand grains; abrupt smooth boundary.

A2—0 to 1½ inches (0–4 cm); gray (10YR 5/1) silt loam; weak very fine granular structure; very friable; many fine roots; fungal mycelia; abrupt irregular boundary.

B21—1½ to 2 inches (4–5 cm); dark reddish brown (5YR 3/4) silt loam; weak very fine granular structure; very friable; common roots; abrupt broken boundary. This horizon occurs in about half of the exposed walls of the pit.

B22—2 to 3½ inches (5–9 cm); dark brown (7.5YR 4/4) silt loam; weak very fine granular structure; very friable; common roots; abrupt wavy boundary.

B23—3½ to 6 inches (9–15 cm); dark yellowish brown (10YR 4/4) silt loam; weak very fine subangular blocky structure; very friable; common roots; clear wavy boundary.

B3—6 to 9 inches (15–22 cm); dark yellowish brown (10YR 4/4) to olive brown (2.5Y 4/4) silt loam; weak fine subangular blocky structure; very friable; common roots; clear wavy boundary.

C1—9 to 14 inches (22–35 cm); olive brown (2.5Y 4/4) silt loam; weak very thin platy structure; very friable; few roots; fine pores; clear wavy boundary.

C2—14 to 19 inches (35–48 cm); olive (5Y 4/3) silt loam; common medium faint mottles of olive brown (2.5Y 4/4); massive; very friable; fine pores; clear smooth boundary.

C3—19 to 24 inches (48–60 cm); olive (5Y 4/3) silt loam; common large distinct mottles of yellowish brown (10YR 5/4); very weak thin platy structure; very friable; few roots; fine pores; abrupt smooth boundary.

IIC4—24 to 32 inches (60–80 cm); olive gray (5Y 4/2 and 5Y 5/2) loam with inbedded pebbles and stones; moderate very fine angular blocky structure; firm; few roots; vesicular.

In some areas, notably the Susitna Valley, two or more similar sequences of horizons are commonly observed in the soil profiles. This occurs in areas where periods of rapid deposition of loess have alternated with periods of little or no deposition during which a typical horizon sequence may develop, or where a blanket of volcanic ash has been deposited over an existing soil.

Pedon *93*, Typic Cryorthods, loamy (Chulitna series). About 4 miles (6 km) west of Talkeetna (*51*).

O1—3 inches to 0 (8–0 cm); dark reddish brown (5YR 2/2) mat of decomposing organic material; fungal mycelia; many coarse and fine roots; thin layer of litter on surface; very thin layer of fine sand grains in the horizon; abrupt smooth boundary.

A2—0 to 1½ inches (0–4 cm); gray (N5/) silt loam; weak very thin platy structure; very friable; common roots; abrupt irregular boundary.

B21—1½ to 3½ inches (4–9 cm); dark reddish brown (2.5YR 3/4) silt loam; weak very fine granular structure; friable, but weakly cemented patches immediately beneath A2; common roots; abrupt broken boundary.

B22—3½ to 6 inches (9–15 cm); strong brown (7.5YR 5/6) silt loam; weak very fine granular structure; friable; common roots; clear wavy boundary.

B3—6 to 9½ inches (15–24 cm); yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; very friable; common roots; clear wavy boundary.

A2b—9½ to 12 inches (24–30 cm); light olive brown (2.5Y 5/4) silt loam; very weak fine subangular blocky structure; very friable; common roots; abrupt wavy boundary.

B21b—12 to 16 inches (30–40 cm); dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure breaking to weak very fine granular; very friable; common roots grading to few; clear wavy boundary.

B22b—16 to 20 inches (40–50 cm); olive brown (2.5Y 4/4) silt loam; weak medium subangular blocky structure; very friable; few roots; fine pores; gradual boundary.

B3b—20 to 26 inches (50–65 cm); olive brown (2.5Y 4/4) to light olive brown (2.5Y 5/4) silt loam; weak medium subangular blocky structure; very friable; few roots; fine pores; gradual boundary.

C1b—26 to 35 inches (65–88 cm); olive (5Y 4/3) coarse silt loam with thin lenses of sand; weak medium subangular blocky structure; very friable; few roots; fine pores; abrupt smooth boundary.

IIC2—35 to 43 inches (88–108 cm); gray (N5/) and dark gray (N4/) stratified sand and loamy fine sand; massive; very friable; few roots; few fine pores; abrupt smooth boundary.

IIC3—43+ inches (108+ cm); stratified coarse sand and gravel.

Where precipitation is fairly low, but still high enough for a spodic horizon to develop, the spodic horizon is quite thin and its dominant color is brown rather than reddish brown.

Pedon *94*, Typic Cryorthods, loamy (McGrath series). About 3 miles (5 km) northeast of McGrath.

O1—3 to 1 inch (8–2 cm); dark reddish brown (5YR 2/2) loose mat of forest litter and moss; many rocks; many reddish yellow (7.5YR 7/6) and white mycelia; extremely acid; abrupt smooth boundary.

O2—1 inch to 0 (2–0 cm); dark reddish brown (5YR 2/2) finely divided organic matter; many charcoal fragments; many roots; fungal mycelia; extremely acid; abrupt smooth boundary.

A2—0 to 1½ inches (0–4 cm); gray (10YR 5/1) silt loam; weak very fine granular structure; very friable; many roots; fungal mycelia; extremely acid; abrupt wavy boundary.

B21—1½ to 3½ inches (4–9 cm); dark brown (7.5YR 4/4) silt loam; weak fine subangular blocky structure; many roots; few mycelia; few charcoal fragments; few soft concretions slightly darker than soil mass; very strongly acid; clear wavy boundary.

B22—3½ to 7 inches (9–18 cm); dark yellowish brown (10YR 4/4) silt loam; patches of dark brown (10YR 4/3); weak fine to medium subangular blocky structure; very friable; common roots; few concretions like those in B21 horizon; few charcoal fragments; very strongly acid; clear wavy boundary.

B3—7 to 12 inches (18–30 cm); dark brown (10YR 4/3) silt loam; weak very thin platy structure; very friable; common roots; few concretions like those in B21 horizon; very strongly acid; clear wavy boundary.

C—12 to 40 inches (30–100 cm); streaked gray (5Y 5/1) and brown (10YR 4/3) silt loam; few fine distinct mottles of dark brown (7.5YR 4/4); moderate very thin platy structure; very friable; few roots; strongly acid; more than 3 feet thick.

Typic Cryorthods form on very coarse parent material even in areas where precipitation is low. In such areas, the dominant soils on well drained uplands are Typic Cryochrepts.

Pedon *95*, Typic Cryorthods, very gravelly (Homestead series). About 7 miles (11 km) west of Wasilla (*53*).

O11—3 to 2½ inches (8–6 cm); forest litter.

O12—2½ inches to 0 (6–0 cm); very dark brown (10YR 2/2) mat of roots and partially decomposed organic material; few mycelia; abrupt smooth boundary.

A2—0 to 3 inches (0–8 cm); dark gray (5Y 4/1) silt loam; weak very fine granular structure; friable; common roots; abrupt irregular boundary.

B2—3 to 7 inches (8–18 cm); mixed dark yellowish brown (10YR 4/4), brownish yellow (10YR 6/8), and reddish yellow (5YR 6/8) silt loam, with dark yellowish brown the dominant color; colors occur as large patches rather than as mottles; weak fine subangular blocky structure; friable; few roots; clear wavy boundary.

B3—7 to 10 inches (18–25 cm); mixed brown (10YR 5/3) and yellowish brown (10YR 5/4) silt loam with few patches and streaks of dark brown (10YR 3/3); weak fine subangular blocky structure; friable; few roots; clear wavy boundary.

IIC—10 to 24 inches (25–60 cm); yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) gravelly sandy loam; single grain; loose; very few roots.

Pedon *95a*, Typic Cryorthods, very gravelly (unnamed series). About ½ mile (1 km) south of Chandalar airstrip.

O1—1 inch to 0 (2–0 cm); very dark brown (10YR 2/2) mat of decomposing moss and forest litter; many fine roots; abrupt wavy boundary.

A2—0 to 1 inch (9–2 cm); gray (5Y 6/1) fine sandy loam; weak fine granular structure; very friable; abrupt broken boundary.

B2—1 inch to 6½ inches (2–16 cm); dark yellowish brown (10YR 4/4) gravelly sandy loam; patches of dark brown (7.5YR 4/4) surround large pebbles; weak fine granular structure; very friable; roots common; few iron concretions; clear wavy boundary.

B3—6½ to 8 inches (16–20 cm); dark grayish brown (10YR 4/2) very gravelly sand; single grain; loose; few roots; clear wavy boundary.

C—8 to 18 inches (20–45 cm); dark grayish brown (2.5Y 4/2) very gravelly sand; loose.

These soils also form in vegetated dunes along the coast of the Gulf of Alaska. On older dunes the spodic horizon in this sandy material is fairly brittle.

Pedon *96*, Typic Cryorthods, sandy (unnamed series). About 30 miles (48 km) east of Yakutat.

O1—2½ inches to 1 inch (6–2 cm); forest litter.

O2—1 inch to 0 (2–0 cm); black (5YR 2/1) well decomposed organic matter; abrupt smooth boundary.

A2—0 to 3 inches (0–8 cm); dark gray (10YR 4/1) silt

loam; patches of dark brown (7.5YR 3/2); weak very thin platy structure; very friable; abrupt wavy boundary.

B21—3 to 3½ inches (8–9 cm); dark reddish brown (5YR 3/3) loamy sand, with very dusky red (2.5YR 2/2) coatings on ped faces; strong medium platy structure, parting to strong fine blocky; strongly cemented; clear wavy boundary.

B22—3½ to 14 inches (9–35 cm); dark reddish brown (5YR 3/3) loamy sand; moderate medium platy structure; weakly cemented and brittle; mycelia; clear wavy boundary.

B23—14 to 25 inches (35–62 cm); dark reddish brown (5YR 3/3) sand; single grain; loose; gradual boundary.

C1—25 to 36 inches (62–90 cm); very dark grayish brown (10YR 3/2) sand; single grain; loose; gradual boundary.

C2—36 to 45 inches (90–112 cm); very dark grayish brown (2.5Y 3/2) sand; single grain; loose.

In areas above tree line in parts of the South Central Alaska Mountains close to the Gulf of Alaska and Cook Inlet, where mean annual soil temperatures are above freezing, thin Typic Cryorthods formed under alpine tundra vegetation. These soils are commonly gravelly. Many are only moderately deep over bedrock.

Pedon *97*, Typic Cryorthods, loamy (unnamed series). Near summit of Thompson Pass, Chugach Mountains.

O1—2 inches to 0 (5–0 cm); dark reddish brown (5YR 3/2) mat of partially decomposed organic material; many roots; abrupt smooth boundary.

A1—0 to 1½ inches (0–4 cm); dark brown (7.5YR 3/2) silt loam; weak very fine granular structure; very friable; many roots; abrupt wavy boundary.

A2—1½ to 3½ inches (4–9 cm); dark gray (10YR 4/1) gravelly silt loam; weak fine granular structure; very friable; many roots; abrupt wavy boundary.

B22—3½ to 9 inches (15–22 cm); very dark grayish brown (10YR 3/2) gravelly loam; weak fine granular structure; slightly smeary when rubbed; common roots; clear wavy boundary.

B3—9 to 15 inches (22–38 cm); dark grayish brown (10YR 4/2) gravelly loam; weak very fine subangular blocky structure; slightly smeary when rubbed; common roots; clear wavy boundary.

C—15 to 24 inches (38–60 cm); olive gray (5Y 4/2) very gravelly loam; weak very fine subangular blocky structure; friable; few roots.

Entic Cryorthods have only small amounts of organic matter in the spodic horizon. They occur only on young material, such as recently stabilized dunes, and probably will develop into Typic Cryorthods in time.

Pedon *98*, Entic Cryorthods, sandy (Anchorage series). About 2 miles (3 km) southwest of Knik (*57*).

O1—2 inches to 0 (5–0 cm); dark reddish brown (5YR 2/2) mat of decomposing organic material; extremely acid; abrupt wavy boundary.

A2—0 to 1 inch (0–2 cm); gray (10YR 5/1) silt loam; very weak medium platy structure; very friable; common roots; extremely acid; abrupt irregular boundary.

B21—1 to 2 inches (2–5 cm); dark brown (7.5YR 4/4) very fine sandy loam; pockets of yellowish red (5YR 4/6); weak medium granular structure; very friable; common roots; extremely acid; abrupt irregular boundary.

B22—2 to 6 inches (5–15 cm); brown (10YR 4/3) very fine sandy loam with yellowish brown (10YR 5/4) streaks and patches; very weak medium granular structure; very friable; common roots; very strongly acid; clear wavy boundary.

B3—6 to 12 inches (15–30 cm); light olive brown (2.5Y 5/4) fine sand; single grain; loose; few roots; strongly acid; clear wavy boundary.

C—12 to 40 inches (30–100 cm); olive (5Y 4/3) sand; single grain; loose; yellowish brown (10YR 5/4), weakly cemented, undulating bands ⅛ inch (3 mm) thick at a depth between 30 (76 cm) and 37 inches (94 cm); very few roots; strongly acid. Many feet thick.

Humic Cryorthods have large accumulations of organic matter in at least the upper part of the spodic horizon. They are similar in appearance and thickness to the Typic Cryohumods, but have a higher iron content. These are the dominant soils of well drained forested uplands in Southeastern Alaska, areas along the north shore of the Gulf of Alaska, and areas with high precipitation rates west of the Alaska and Aleutian Ranges. They also occur under grass and alder vegetation in the southernmost part of the Kuskokwim Highlands and in areas directly above tree line bordering the Cook Inlet-Susitna Lowland.

They develop from a wide variety of parent material. The developed soil has many of the same chemical properties everywhere, but the influence of the parent material is reflected in physical properties and in properties of the soil below the spodic horizon. Many of the soils formed in gravelly glacial moraine material. Some have an admixture of loess in the upper part.

Pedon *99*, Humic Cryorthods, very gravelly (Kupreanof series). About 8 miles north of Seward.

O1—4 inches to ½ inch (10–1 cm); dark reddish brown (5YR 2/2) partially decomposed forest litter; many roots; many mycelia; abrupt smooth boundary.

O2—½ inch to 0 (1–0 cm); dark reddish brown (5YR 2/2) finely divided organic matter; many roots; abrupt smooth boundary.

A21—0 to 4 inches (0–10 cm); dark grayish brown (10YR 4/2) silt loam, with 5 to 10 percent fine gravel; many streaks and patches of very dark brown (10YR 2/2) silt loam; weak very thin platy structure; very friable; many roots; abrupt wavy boundary.

A22—4 to 7 inches (10–18 cm); dark gray (5Y 4/1) gravelly silt loam; weak very thin platy structure; very friable; common roots; abrupt irregular boundary. A discontinuous layer of black (N 2/) muck occurs at the top of this horizon; not included in sample.

B21h—7 to 8 inches (18–20 cm); reddish black (10YR 2/1) gravelly silt loam; moderate very fine granular structure; very friable, smeary when rubbed; common roots; mycelia; abrupt irregular boundary.

B22ir—8 to 11 inches (20–28 cm); very dusky red (2.5YR 2/2) gravelly silt loam; weak very fine granular structure; smeary when rubbed; few roots; clear wavy boundary.

B23ir—11 to 17 inches (28–43 cm); dark reddish brown (2.5YR 2/4) gravelly loam; weak very thin platy structure parting to weak very fine granular; smeary when rubbed; few roots; clear wavy boundary.

B3—17 to 20 inches (43–51 cm); dark reddish brown (5YR 2/2) very gravelly loam; weak fine subangular blocky structure; smeary when rubbed; no roots; abrupt wavy boundary.

C—20 to 32 inches (51–81 cm); dark olive gray (5Y 3/2) very gravelly sandy loam; dark reddish brown (5YR 3/3 and 2.5YR 2/4) streaks, patches, and coatings on pebbles; massive; very firm, but friable when disturbed; no roots.

Other parent material includes weathered metamorphic and igneous rocks, and even limestone.

Pedon *100*, Humic Cryorthods, loamy (Ulloa series). About 1½ miles (2 km) south of Klawock.

O11—4 to 3 inches (10–8 cm); litter of needles, twigs, and cones; (pH 3.6); abrupt wavy boundary.

O12—3 inches to 0 (8–0 cm); very dusky red (2.5YR 2/2) moderately decomposed organic matter with few fine faint manganese concretions; abundant very fine roots; extremely acid; abrupt wavy boundary.

A2—0 to 1 inch (0–2 cm); grayish brown (10YR 5/2)

silt loam; weak very fine subangular blocky parting to weak fine granular structure; friable; common fine and few medium roots; extremely acid; abrupt wavy boundary.

B21h—1 inch to 3½ inches (2–9 cm); very dusky red (2.5YR 2/2) loam with white mold between peds; moderate fine subangular blocky structure; very friable; few fine roots; extremely acid; abrupt broken boundary.

B22ir—3½ to 6 inches (9–15 cm); dark reddish brown (5YR 3/3) loam; moderate fine subangular blocky parting to weak fine subangular blocky structure; very friable; few medium and very fine roots; extremely acid; clear wavy boundary.

B3—6 to 12 inches (15–30 cm); dark reddish brown (5YR 3/4) silt loam with dark grayish brown (2.5Y 4/2) pockets; weak fine granular structure; friable; few coarse and very few fine roots; slightly acid; clear wavy boundary.

C1—12 to 19 inches (30–48 cm); dark brown (7.5YR 3/2) silt loam; weak fine subangular blocky parting to weak fine granular structure; slightly sticky and plastic; 1 percent stones; very few fine and coarse roots; neutral; clear wavy boundary.

C2—19 to 24 inches (48–60 cm); dark brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; slightly sticky and plastic; 10 percent stones; slightly acid; abrupt wavy boundary.

C3—24 to 32 inches (60–80 cm); dark reddish brown (5YR 3/2) silt loam with dark brown (7.5YR 3/2) pockets; moderate fine subangular blocky structure; slightly sticky and plastic; 5 percent gravel; neutral; abrupt wavy boundary.

C4—32 to 39 inches (80–98 cm); dark brown (10YR 4/3) silty clay loam with some dark brown (7.5YR 3/2); weak fine subangular blocky structure; slightly sticky and plastic; 10 percent gravel; neutral (pH 6.8); abrupt wavy boundary.

C5—39 to 46 inches (98–115 cm); dark reddish brown (5YR 2/2) very gravelly silt loam; massive; friable; 85 percent gravel; neutral.

Humic Cryorthods also form in volcanic deposits. These soils commonly have visible properties that closely resemble those of Typic Cryohumods. Because of this similarity, many ashy soils properly classified as Typic Cryohumods were included with the Humic Cryorthods in the mapping.

Pedon *101*, Humic Cryorthods, loamy (Aleknagik series). About 4 miles (6 km) northwest of Dillingham.

O1—5 inches to 0 (13–0 cm); dark reddish brown (5YR 2/2) partially decomposed organic material and hypnum mosses; many roots; abrupt smooth boundary.

A2—0 to 1½ inches (0–4 cm); dark grayish brown (10YR 4/2) silt loam; weak very fine granular structure; very friable; many roots; abrupt wavy boundary.

B21h—1½ to 4 inches (4–10 cm); very dusky red (2.5YR 2/2) silt loam; very thin intermittent upper layer of reddish black (10YR 2/1); moderate very fine granular structure; very friable, slightly smeary when rubbed; common roots; abrupt irregular boundary.

B22h—4 to 7 inches (10–18 cm); dark reddish brown (2.5YR 2/4) silt loam; patches of dark brown (7.5YR 4/4) in lower part of horizon; moderate very fine granular structure; very friable, slightly smeary when rubbed; common roots; abrupt wavy boundary.

B31—7 to 11 inches (18–28 cm); dark yellowish brown (10YR 4/4) silt loam; large patches of yellowish brown (10YR 5/4); weak very thin platy structure; very friable; common roots; abrupt wavy boundary.

B32—11 to 26 inches (28–66 cm); dark brown (10YR 4/3) silt loam; patches of brown (10YR 5/3); weak very thin platy structure; very friable; few roots; many fine soft nodules with reddish brown (5YR 5/4) interiors; clear wavy boundary.

C—26 to 36 inches (66–91 cm); gray (5Y 5/1) silt loam; many roughly horizontal streaks of dark brown (7.5YR 4/4); weak very thin platy structure; very friable; no roots; few fairly hard irregular nodules up to ¼ inch (6 mm) thick with dark reddish brown (5YR 3/4) interiors.

Humic Lithic Cryorthods are identical with Humic Cryorthods except that the soils are less than 20 inches (50 cm) thick over bedrock.

Pedon *102*, Humic Lithic Cryorthods, very gravelly (Tolstoi series). Vicinity of Hollis, Prince of Wales Island.

O11—6 to 5 inches (15–12 cm); live mosses and litter of twigs, needles, and cones.

O12—5 inches to 1 inch (12–2 cm); black (5YR 2/1) moderately decomposed organic matter; abundant very fine and fine and common medium and coarse roots; extremely acid; clear wavy boundary.

O2—1 inch to 0 (2–0 cm); very dusky red (2.5YR 2/2) highly decomposed organic matter; many very fine and fine and common medium and coarse roots; extremely acid; abrupt wavy boundary.

A2—0 to ½ inch (0–1 cm); grayish brown (10YR 5/2) loam; weak very fine granular structure; very friable; many very fine and few coarse and medium roots; extremely acid; abrupt broken boundary.

B21h—½ inch to 1½ inches (1–4 cm); black (5YR 2/1) silt loam; weak fine subangular blocky structure; friable; many fine and few medium roots; extremely acid; abrupt wavy boundary.

B22ir—1½ to 3 inches (4–8 cm); dark reddish brown (5YR 3/4) loam; weak fine subangular blocky structure; friable; many fine and few medium roots; extremely acid; abrupt wavy boundary.

B3—3 to 12 inches (8–30 cm); yellowish red (5YR 4/8) gravelly sandy loam with light gray (10YR 7/2) pockets and some white mycelia; weak very fine granular structure; nonsticky and plastic; 15 percent gravel; common fine and few medium roots; very strongly acid; clear wavy boundary.

C1—12 to 15 inches (30–38 cm); dark reddish brown (5YR 3/4) gravelly sandy loam; moderate fine subangular blocky structure; friable; 15 percent gravel; common fine and few medium roots; extremely acid; clear wavy boundary.

C2—15 to 21 inches (38–52 cm); dark reddish brown (5YR 2/2) gravelly sandy loam; weak medium subangular blocky structure; friable; 20 percent gravel; common fine and few medium roots; extremely acid; clear wavy boundary.

C3—21 to 28 inches (52–70 cm); very dark brown (10YR 2/2) very gravelly loam with light gray (10YR 7/2) decomposed pebbles; massive; friable; 35 percent gravel; extremely acid; clear wavy boundary.

C4—28 to 33 inches (70–83 cm); mixed reddish brown (5YR 4/4), dark reddish brown (5YR 2/2), and very dusky red (2.5YR 2/2) very gravelly loam; weak very fine subangular blocky structure; friable; 75 percent angular gravel; extremely acid; abrupt wavy boundary.

R—33+ inches (83+ cm); metamorphosed sedimentary bedrock.

Lithic Cryorthods are soils with moderate amounts of organic carbon in the spodic horizon. They are less than 20 inches (50 cm) thick over bedrock. Most of these soils in Alaska are in areas above tree line and have developed under low shrubs and other plants of the alpine tundra. Those close to the south central coast of Alaska have mean annual temperatures above freezing and, because of normally thick winter snow cover, are seldom frozen. Those in interior areas have temperatures below freezing and are frozen throughout the winter.

Pedon *103*, Lithic Cryorthods, very gravelly (unnamed series). In Talkeetna Mountains about 14 miles (22 km) northwest of Palmer.

O1—1 inch to 0 (2–0 cm); dark reddish brown (5YR 2/2) mat of partially decomposed organic material; many roots; abrupt smooth boundary.

A1—0 to 2 inches (0–5 cm); very dark grayish brown (10YR 3/2) silt loam; weak very fine granular structure; very friable, slightly smeary when rubbed; many roots; abrupt wavy boundary.

B2—2 to 7 inches (5–18 cm); dark reddish brown (5YR 3/3) silt loam; weak very fine subangular blocky structure; smeary when rubbed; common roots; clear wavy boundary.

B3—7 to 10 inches (18–25 cm); dark brown (10YR 4/3) silt loam with streaks of dark brown (7.5YR 3/2) and brown (7.5YR 5/3); weak fine subangular blocky structure, with tendency to platiness; smeary when rubbed; common roots; abrupt wavy boundary.

IIC1—10 to 17 inches (25–42 cm); dark brown (10YR 4/3) very gravelly sandy loam, apparently weathered granite; most of the gravel is finer than 2 cm; single grain; loose; few roots; abrupt wavy boundary.

R—17+ inches (42+ cm); granitic bedrock.

Pergelic Cryorthods have mean annual temperatures below freezing. They are extensive in areas above tree line in interior Alaska and a few occur in arctic tundra areas. Commonly, the soils formed in gravelly material on sites with good external drainage. The developed profile normally is very thin.

Pedon *104*, Pergelic Cryorthods, very gravelly (unnamed series). About 20 miles (32 km) southeast of Eureka (*37*).

O1—1½ inches to 0 (4–0 cm); fibrous peat with many fine and medium roots.

A2—0 to 1½ inches (0–4 cm); grayish brown (10YR 5/2) silt loam; very friable; very weak fine granular structure; many woody roots.

B21—1½ to 2½ inches (4–6 cm); yellowish brown (10YR 5/4) silt loam; friable; weak medium and fine granular to crumb structure; common fine woody roots.

B22—2½ to 5 inches (6–12 cm); yellowish brown to light olive brown (10YR 5/4) sandy loam; massive; very friable; nonplastic and nonsticky; common woody roots.

C—5+ inches (12+ cm); grayish brown to light olive brown (2.5Y 5/3) gravelly sandy loam; single grained; loose.

In an area in the northern part of the Copper River Plateau and in the easternmost part of the Interior Highlands south of the Yukon River, two sequences of horizons occur in the profile. The upper sequence has developed in volcanic ash believed to have been deposited about 1,400 years ago.

Pedon *105*, Pergelic Cryorthods, very gravelly (unnamed series). About 4 miles (6 km) northwest of Denali Airstrip.

O1—3 inches to 0 (8–0 cm); dark reddish brown (5YR 2/2) mat of decomposing organic matter; many roots; abrupt smooth boundary.

A2—0 to 1 inch (0–2 cm); dark grayish brown (10YR 4/2) silt loam; patches of reddish gray (5Y 5/2); weak fine granular structure; friable; many roots; abrupt irregular boundary.

B2—1 inch to 3 inches (2–8 cm); dark reddish brown (5YR 3/3) silt loam; weak fine granular structure; very friable; few fine dark concretions; common roots; few rounded pebbles; very strongly acid; abrupt irregular boundary.

IIB3—3 to 7 inches (8–18 cm); dark brown (7.5YR 4/4) sandy loam; few pockets of yellowish brown (10YR 5/4, 5/6) volcanic ash; weak very fine granular structure; very friable; few roots; very strongly acid; abrupt smooth boundary.

IIA2b—7 to 9 inches (18–22 cm); dark gray (10YR 4/1) sandy loam; weak very thin platy structure; friable; few roots; very strongly acid; abrupt broken boundary.

IIB2b—9 to 11 inches (22–28 cm); dark yellowish brown (10YR 3/4) sandy loam; few pockets of yellowish brown (10YR 5/4, 5/6) ash; weak fine granular structure; very friable; few roots; very strongly acid; clear wavy boundary.

IIIB3b—11 to 14 inches (28–35 cm); olive brown (2.5Y 4/4) gravelly sandy loam; massive; very friable; strongly acid; clear wavy boundary.

IIIC—14 to 38 inches (35–95 cm); olive (5Y 4/3) very gravelly sandy loam; massive; nonsticky, nonplastic; medium acid.

In the arctic, Pergelic Cryorthods have developed only where large quantities of water percolate through coarse-grained soils. Sites include microdepressions in uplands and places where snowbanks persist through much of the summer. These soils in the arctic are confined to the Brooks Range and moraines directly north of the Range.

Pedon *106*, Pergelic Cryorthods, very gravelly (unnamed series). Okpilak Valley, Brooks Range (*9*).

O1—1 inch to 0 (2–0 cm); very thin discontinuous layer of loose lichens and woody stems over a dark brown fibrous dry peat.

A1—0 to 3 inches (0–8 cm); very dark gray (5YR 3/1), greasy, moist organic layer having a gravelly sandy loam texture; cobbles and gravel are clean with bleached upper surfaces and some underside staining; thickness varies considerably; extremely acid.

A2—3 to 4½ inches (8–11 cm); dark reddish gray (5YR 4/2) gravelly sandy loam follows the contour of the overlying A horizon, with thickness of ½ to 1½ inches (1.3 to 3.8 cm) at depths from 1 to 5 inches (2.5 to 13 cm) below the surface; woody roots present; cobbles and gravel are clean and similar in composition to those above; 35 percent of mineral material is greater than 2 mm; very strongly acid.

B2—4½ to 10 inches (11–25 cm); dark yellowish brown (10YR 3/4) gravelly loam; cobbles and gravel have distinct thin silt skins on upper surfaces; lower boundary fairly uniform at the 9- to 10-inch depth (23 to 25 cm); roots hairlike and fibrous; some underside staining on larger pebbles; 20 percent of mineral material is greater than 2 mm.

B3—10 to 14 inches (25–35 cm); dark gray brown (10YR 4/2) very gravelly sandy loam with much pea-size gravel, giving a loose, single grain appearance; considerable silt skins, but less staining than above; colors gradational to C horizon at about 14-inch depth (35 cm); 35 percent of mineral material is greater than 2 mm; strongly acid.

C—14+ inches (35+ cm); gray brown (2.5Y 5/2) very gravelly sandy loam; rounded gravel and cobbles mixed with more shaly fragments; sampled to 18-inch depth (46 cm); all coarse material have considerable skins; several large boulders; the active layer is thick and of the dry type; 50 percent of mineral material is greater than 2 mm; strongly acid.

Cryic Fragiorthods are Spodosols underlain by a fragipan that is brittle when moist and very hard when dry. The soil above the fragipan is similar to either the Typic or the Humic Cryorthods, except that the layer just above the slowly permeable substratum may be mottled. Soils of this subgroup are known to occur only on glacial moraines in southeastern Alaska and areas bordering the north coast of the Gulf of Alaska.

Pedon *107*, Cryic Fragiorthods, very gravelly (Karta series). Vicinity of Hollis, Prince of Wales Island.

O11—5 to 4 inches (12–10 cm); litter of mosses, bark, wood chips, twigs, and a few forbs.

O12—4 to 1½ inches (10–4 cm); dark reddish brown (5YR 2/2) moderately decomposed organic matter; common fine and medium roots; extremely acid.

O2—1½ inches to 0 (4–0 cm); black (5YR 2/1) and dark reddish brown (2.5YR 2/4) well decomposed organic matter; common fine and medium and few coarse roots; extremely acid; abrupt smooth boundary.

A2—0 to ½ inch (0–1 cm); pale brown (10YR 6/3) and dark gray (10YR 4/1) silt loam; weak fine subangular blocky structure; friable; 5 percent gravel; common fine

and medium and few coarse roots; extremely acid; abrupt smooth boundary.

B21h—½ inch to 2 inches (1–5 cm); dark reddish brown (5YR 3/4 and 2/2) silt loam; weak fine subangular blocky structure; friable; 5 percent gravel; few fine medium and coarse roots; extremely acid; clear wavy boundary.

B22ir—2 to 7 inches (5–18 cm); yellowish red (5YR 4/6) and reddish brown (5YR 4/4) silt loam; weak fine subangular blocky structure; very friable; 10 percent gravel; few fine medium and coarse roots; very strongly acid; gradual wavy boundary.

B23—7 to 22 inches (18–55 cm); mixed yellowish red (5YR 4/8) reddish brown (5YR 4/4) light yellowish brown (10YR 6/4) and yellow (10YR 7/6) very gravelly silt loam; weak medium subangular blocky structure; friable; 40 percent gravel and cobbles; few medium and coarse roots; very strongly acid; clear wavy boundary.

B3—22 to 29 inches (55–72 cm); dark reddish brown (5YR 3/4) and dark brown (7.5YR 4/4) very gravelly loam; weak fine granular structure; friable; 50 percent gravel and cobbles; few medium and coarse roots; very strongly acid; clear smooth boundary.

C1—29 to 40 inches (72–100 cm); mixed dark reddish brown (5YR 3/4 and 2/2) and grayish brown (2.5Y 5/2) very gravelly silty clay loam; massive; friable; 50 percent gravel and cobbles; few medium and coarse roots; medium acid; clear smooth boundary.

C2x—40 to 48 inches (100–120 cm); olive gray (5Y 5/2) very gravelly sandy clay loam; common medium prominent yellowish red (5YR 4/8) mottles; massive; very firm; 75 percent gravel and cobbles; slightly acid.

Laboratory data

The analytical data in table 3 are based on analyses by Beltsville, Lincoln, and Riverside Soil Survey Laboratories, except for pedon 51, which was analyzed by Ohio State University. Soil scientists of the Soil Conservation Service selected the sites and collected the samples.

Sample collection and preparation and methods of analyses are described in Soil Survey Investigations Report No. 1 (*81*). Codes in the following list refer to methods used, as described in that publication:

	Codes
Particle-size analyses	1B1b and 3A1
Water retention	4B1c and 4B2
Soil reaction (pH 1:1 H_2O, unless otherwise noted)	8C1a
Organic carbon (samples containing more than about 8% organic carbon were analyzed by either method 6A1b or 6A2)	6A1a, or 6A1b or 6A2
Organic nitrogen	6B1a
Extractable iron (dithionite citrate extractable Fe)	6C2b
Extractable aluminum (KCl extractable)	6G1e
Extractable calcium (NH_4OAc extraction)	6N2a
Extractable magnesium (NH_4OAc extraction)	6O2a
Extractable sodium (NH_4OAc extraction)	6P2a
Extractable potassium (NH_4OAc extraction)	6Q2a
Extractable acidity ($BaCl_2$-triethanolamine)	GH1a
Exchange capacity (NH_4OAc)	5A1a or 5A6a
Exchange capacity (Sum of cations)	5A3a
Base saturation (NH_4OAc, pH 7)	5C1
Base saturation (sum of cations, pH 8.2)	5C3

During sampling, hard rock fragments between ¾ and 3 inches in diameter were weighed in the field and discarded. The volume of hard rock larger than 3 inches was estimated. The samples were air dried, passed through 5-mm (No. 4) and 2-mm (No. 10) round-hole sieves, and the 2- to 5-mm fraction weighed and discarded. All data are for the <2-mm soil and are on an ovendry basis (105° C) unless otherwise noted. The symbol *Tr* in the table indicates only trace amounts were detected. Dashes (—) in the table indicate the analysis was run but none was detected.

Map units

Map units in this exploratory survey are associations of phases of soil subgroups and, where applicable, miscellaneous areas. The phases are of two kinds, topographic and textural. Soils are identified as either nearly level, nearly level to rolling (slope gradients dominantly less than 12 percent), hilly to steep (slope gradients steeper than 12 percent), or, in a few areas, nearly level to steep. They are classified into one of four textural groups—clayey, loamy, sandy, or very gravelly.

The textural classification commonly applies to the parts of the pedon between depths of 10 and 40 inches, or between 10 inches and consolidated bedrock shallower than 40 inches. Where bedrock is shallower than 14 inches, the classification applies to all of the soil material above the rock. In soils that are perennially frozen above 40 inches, it applies to the soil above the frozen layer and to the upper 10 inches of the permafrost. In soils with contrasting textures within these limits, the dominant texture is used. Sandy soils are those in which, within these depths, at least 70 percent by weight of the mineral soil passing through a 2-mm screen consists of particles larger than 0.1 mm in diameter (larger percentages are required if clay is present). Clayey soils are those in which more than 35 percent by weight is particles finer than 0.002 mm. All others, except the very gravelly soils, are classified as loamy. Very gravelly soils are those in which particles larger than 2 mm make up at least 35 percent of the soil volume regardless of the composition of the finer material.

In essence, each map unit or soil association consists of segments of the landscape with a distinctive topographic and soil pattern. Almost all of these landscape segments contain soils representative of several subgroups and many include soils of several topographic phases and textural phases. Each map unit is named for the one or two most extensive phases of the subgroup or miscellaneous area represented. The less extensive soils within a map unit are not identified in the name but are noted in the description of the unit.

Symbols that represent each map unit are made up, in most cases, of two letters and one or two numerals. The letters are derived from the order and suborder of the most extensive component soil, as follows:

EA—Aquent
EF—Fluvent
EO—Orthent
HY—Fibrist
IA–Andept
IQ—Aquept
IR—Ochrept
IU—Umbrept
MA—Aquoll
MB—Boroll
SH—Humod
SO—Orthod

Other symbols are used where the dominant component of the map unit is a miscellaneous area, that is, an area that is largely unvegetated and where no soil is recognized. These are:

CL—Cinder land
DL—Dune land
LF—Lava flows
RM—Rough mountainous land

Following the suborder designation, map units are numbered consecutively according to the textural phase of the dominant soil, its topographic phase, and the name of the second component of the association. Except in the case of Rough mountainous land, numbers are not used for map units that consist dominantly of a miscellaneous area.

Each map unit or soil association and its principal components are described briefly in this section. More detailed descriptions of one or more pedons representative of each subgroup are in the section "Soil orders and subgroups in Alaska." Physical and chemical analyses of selected pedons are given in table 3.

The location and distribution of the map units are shown on the map at the back of this survey. The acreage of each unit in each major land resource area is listed in table 5.

The reference number at the end of each component description in this section is the entry in table 6 that lists suitability and limitation ratings for the component. Percentages in parentheses indicate the relative extents of the components within each map unit.

CL—Cinder land is in the following major land resource areas:

	Acres
171 Alaska Peninsula and Southwestern Islands	526,000
178 Western Alaska Coastal Plains and Deltas	127,000
Total	653,000

Areas of fresh volcanic ash and cinder flows occur on slopes of active volcanoes on the Alaska Peninsula, the Aleutian Islands, and Augustine Island at the mouth of Cook Inlet (fig. 5). These areas have little or no vegetation except for willows and grasses in deeply incised drainageways. The loose ash is highly subject to disturbance by wind.

These areas have no value for agriculture or forestry and little value for grazing. Because of the instability of the volcanic material and the possibility of future depositions, they are poor sites for roads or buildings. The paucity of vegetation restricts their value for most wildlife.

Principal components:

Cinder land (80 percent) occurs in a series of flow paths on the lower slopes of volcanoes and adjoining plains. New deposits may occur at any time. See *140* in table 6.

Typic Cryandepts, loamy, nearly level (20 percent) are in areas between cinder flows that have been stable for some time. A sparse, but permanent, vegetation of grasses, alder, and other shrubs has developed. The soils are mostly coarse ash particles with thin layers of finer ash. See *44* in table 6.

DL—Dune land is in the following major land resource areas:

	Acres
176 Interior Alaska Highlands	33,000
177 Norton Sound Highlands	11,000
Total	44,000

Small areas in the Kobuk and Koyukuk Valleys are covered by active sand dunes. The dunes are mostly barren, but trees and shrubs occupy a few low areas where the water table probably is close to the surface. Adjoining areas of dunes are now stabilized and forested. It is likely that the forest will eventually cover the remaining active dunes.

The lack of vegetation and the instability of the dunes severely limit their suitability for any use. See *141* in table 6.

EA1—Typic Cryaquents, loamy nearly level-Terric Cryohemists, nearly level association is in the following major land resource area:

	Acres
169 South Central Alaska Mountains	203,000

This association occupies most of the Copper River Delta and adjoining lowlands on the north coast of the Gulf of Alaska. Except for a few dunes and moraines, nearly all areas are less than 200 feet above sea level. Large marshy areas, meandering sloughs, and shallow ponds are common in the treeless coastal part of the Delta. In areas closer to the mountains are nearly level terraces, alluvial fans, braided flood plains of glacier-fed streams, and scattered moraines. Many parts of the association are susceptible to flooding, and parts of the delta are frequently inundated by tidewater.

The sediment in delta areas consists dominantly of waterlaid silts and clays. Terraces, fans, and flood plains consist mainly of alluvial silts and fine sands that vary in thickness over very gravelly sand. A few gravelly and stony moraine deposits occur near the mountains. Dunes of eolian sand border some of the flood plains. Shallow depressions in most of the association are filled with peat.

The delta and many of the terraces and flood plains where the water table is near the surface support mainly sedges, mosses, and other water-tolerant plants. Forests of Sitka spruce, hemlock, and cottonwood, along with large patches of tall willow and alder brush, occupy moraines and terraces near the mountains.

The association is in a cool maritime climate. Sum-

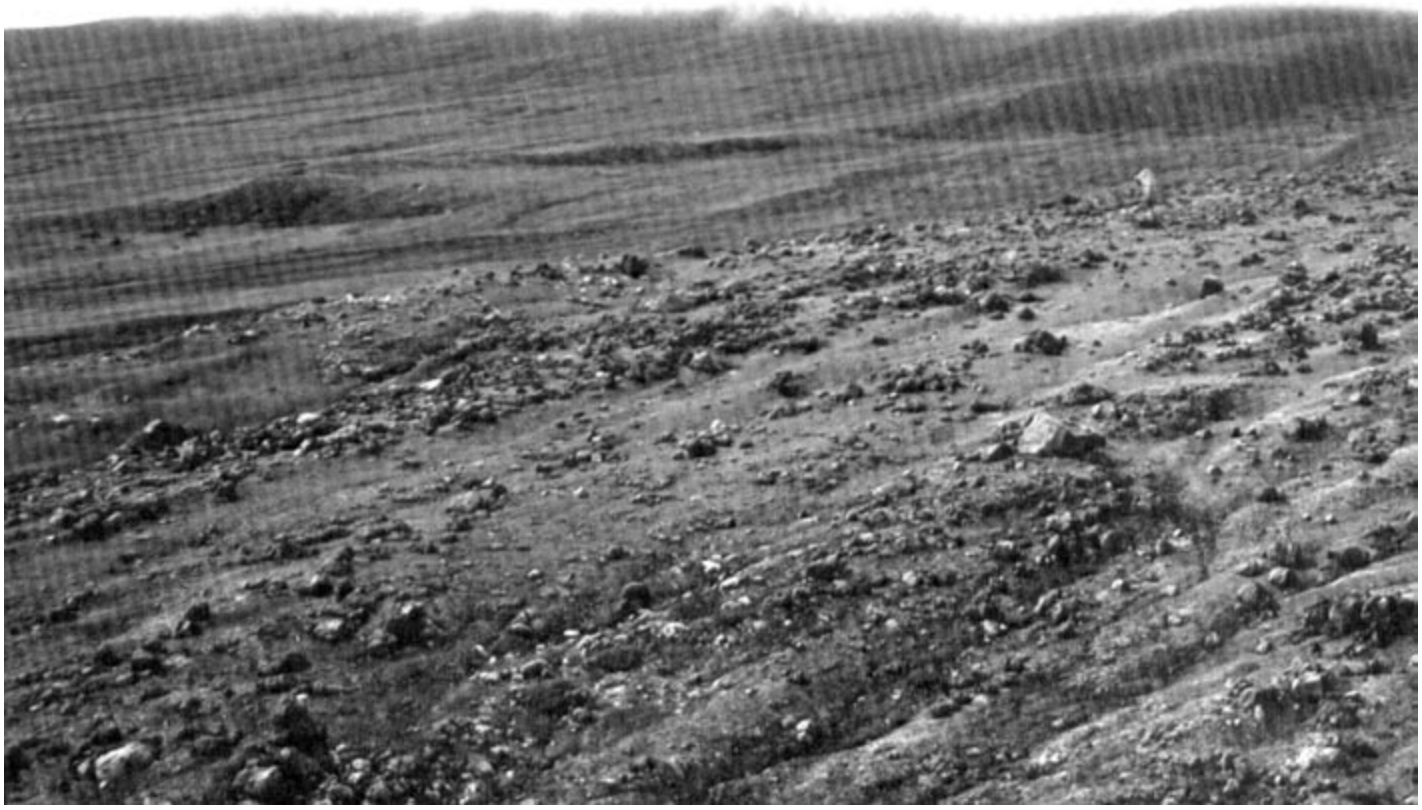

Figure 5.—**Unvegetated recent cinder flows at base of Mt. Augustine.**

mers are cool, and winters are moderately cold. Precipitation, including snowfall, is heavy. There is no permafrost.

Largely because of flooding and a high water table, the most extensive soils in the association are not suitable for cultivation or forestry and have severe limitations for intensive development. Most of these soils provide wildlife habitat for a variety of species, especially migratory waterfowl that concentrate on wetlands of the delta. Generally, the most feasible sites for roads, buildings, and other structures are the nearly level, well drained soils of terraces. Although they are not extensive, these and the soils on hilly moraines commonly support forests of commercial value.

Principal components:

Typic Cryaquents, loamy, nearly level, (35 percent) are poorly drained soils that occupy low terraces, parts of flood plains, and broad marshy areas on the delta of the Copper River. The water table is usually near the surface, and most of the soils are susceptible either to freshwater flooding or to inundation by tidewater. The dominant vegetation is sedges and other water-tolerant plants, but thickets of alder and willow are scattered on the flood plains. In the delta areas the soils usually have a fairly thick surface mat of coarse sedge peat over thick deposits of layered nonacid, dark greenish gray sediment that ranges from silty clay loam to fine sandy loam. A few thin lenses of coarse sedge fibers are commonly buried in the sediments. On flood plains and low terraces the soils generally have a thin peaty surface mat and mottled dark gray stratified silt and fine sand more than 30 inches (75 cm) thick over gravel, sand, and cobblestones. See *2a* and *2b* in table 6.

Terric Cryohemists, nearly level, (25 percent) consists mostly of very poorly drained, partially decomposed, dark brown sedge peat that has accumulated in shallow depressions in delta areas and low terraces. The vegetation is dominantly sedges, mosses, and other water-tolerant plants. The peat is 16 to 50 inches (40 to 125 cm) thick over gray or bluish gray loamy sediment. The upper layer of peat commonly consists of coarse moss and sedge fibers. See *40* in table 6.

Typic Cryofluvents, very gravelly, nearly level, (10 percent) are well drained soils that occupy low terraces and natural levees bordering streams. The vegetation is forest dominated by cottonwood and Sitka spruce. Under a thin surface mat of organic mat-

TABLE 5.—*Acreage of map units in*

[Figures listed represent

Map unit	Southeastern Alaska	South Central Alaska Mountains	Cook Inlet-Susitna Lowland	Alaska Peninsula and Southwestern Islands	Copper River Plateau	Alaska Range	Interior Alaska Lowlands				
							Koyukuk-Innoko Lowland	Kanuti Flats	Tanana-Kuskokwim Lowland	Yukon Flats	Total
CL	—	—	—	526	—	—	—	—	—	—	—
DL	—	—	—	—	—	—	—	—	—	—	—
EA1	—	203	—	—	—	—	—	—	—	—	—
EA2	—	—	450	—	83	—	—	—	—	—	—
EA3	112	349	—	—	—	—	—	—	—	—	—
EA4	—	526	—	—	—	—	—	—	—	—	—
EA5	—	292	—	—	—	—	—	—	—	—	—
EF1	—	51	319	—	—	—	—	—	—	—	—
EF2	—	—	—	—	—	—	—	—	—	1,472	1,472
EO1	—	—	229	—	—	—	—	—	—	—	—
EO2	54	606	—	—	—	—	—	—	—	—	—
EO3	—	—	—	—	—	—	—	—	—	—	—
HY1	—	—	214	—	—	—	—	—	—	—	—
HY2	—	—	—	298	—	—	—	—	—	—	—
HY3	—	—	—	79	—	—	—	—	—	—	—
HY4	—	—	—	—	25	—	—	—	—	69	69
HY5	—	—	—	—	—	—	—	—	—	—	—
IA1	—	—	—	1,026	—	—	—	—	—	—	—
IA2	—	—	—	1,769	—	—	—	—	—	—	—
IA3	—	—	—	272	—	—	—	—	—	—	—
IA4	—	—	—	460	—	—	—	—	—	—	—
IA5	—	—	—	265	—	—	—	—	—	—	—
IA6	—	—	—	435	—	—	—	—	—	—	—
IA7	—	—	—	381	—	—	—	—	—	—	—
IA8	—	—	—	—	—	—	—	—	—	—	—
IA9	—	—	156	2,578	—	84	—	—	—	—	—
IA10	—	—	—	334	—	—	—	—	—	—	—
IA11	—	—	—	2,241	—	—	—	—	—	—	—
IA12	—	—	—	993	—	—	—	—	—	—	—
IA13	—	—	—	—	—	—	—	—	—	—	—
IA14	—	—	47	1,471	—	—	—	—	—	—	—
IA15	—	—	765	47	—	—	—	—	—	—	—
IA16	—	—	—	1,994	—	—	—	—	—	—	—
IA17	—	—	—	533	—	—	—	—	—	—	—
IQ1	—	—	—	—	1,752	—	—	—	—	—	—
IQ2	—	—	—	—	933	98	1,609	1,053	4,160	629	7,451
IQ3	—	—	—	—	—	76	2,251	—	2,306	1,069	5,626
IQ4	—	—	—	—	—	—	—	76	—	—	76
IQ5	—	—	—	—	—	—	—	—	—	—	—
IQ6	—	—	—	—	18	18	4,621	—	2,005	665	7,291
IQ7	—	—	—	—	—	—	—	—	—	—	—
IQ8	—	—	—	—	—	—	36	—	—	—	36
IQ9	—	—	—	—	—	—	—	—	80	377	457
IQ10	—	—	—	—	—	—	—	—	—	—	—
IQ11	—	—	—	—	—	—	—	—	—	—	—
IQ12	—	—	—	—	—	—	—	—	62	—	62
IQ13	—	—	—	—	—	—	—	—	—	—	—
IQ14	—	—	—	—	—	109	—	—	210	—	210
IQ15	—	—	—	—	225	62	—	—	866	—	866
IQ16	—	—	—	—	—	—	—	—	—	—	—
IQ17	—	—	—	—	—	—	—	—	—	—	—
IQ18	—	—	—	—	—	—	—	—	—	—	—
IQ19	—	—	—	—	—	—	—	—	—	—	—
IQ20	—	—	—	—	—	—	—	—	—	—	—
IQ21	—	—	—	—	—	—	—	—	—	—	—
IQ22	—	—	—	—	—	—	—	—	—	—	—
IQ23	—	—	—	—	—	—	—	—	—	—	—
IQ24	—	—	—	—	—	—	—	—	—	—	—
IQ25	—	156	—	—	14	2,306	—	—	—	—	—
IQ26	—	—	—	—	—	424	—	—	—	—	—
IR1	—	—	—	—	—	—	—	—	196	1,856	2,052
IR2	—	—	—	—	—	—	—	—	—	616	616
IR3	—	—	—	—	—	—	—	—	221	—	221
IR4	—	—	—	—	83	—	—	—	—	1,679	1,679
IR5	—	—	—	—	269	—	—	—	—	—	—
IR6	—	—	—	—	—	65	—	—	73	—	73

major land resource areas

thousands of acres]

Kuskokwim Highlands	Interior Alaska Highlands	Norton Sound Highlands	Western Alaska Coastal Plains and Deltas				Bering Sea Islands	Brooks Range	Arctic Foothills	Arctic Coastal Plain	Total acreage
			Selawik-Kobuk Delta	Yukon-Kuskokwim Delta	Bristol Bay Coastal Plain	Total					
—	—	—	—	—	127	127	—	—	—	—	653
—	33	11	—	—	—	—	—	—	—	—	44
—	—	—	—	—	—	—	—	—	—	—	203
—	—	—	—	—	—	—	—	—	—	—	533
—	—	—	—	—	—	—	—	—	—	—	461
—	—	—	—	—	—	—	—	—	—	—	526
—	—	—	—	—	—	—	—	—	—	—	292
236	—	—	—	—	83	83	—	—	—	—	689
—	—	—	—	—	—	—	—	—	—	—	1,472
—	—	—	—	—	—	—	—	—	—	—	229
—	—	—	—	—	—	—	—	—	—	—	660
—	842	—	—	—	—	—	—	—	—	—	842
—	—	—	—	—	—	—	—	—	—	—	214
—	—	—	—	—	968	968	—	—	—	—	1,266
—	—	—	—	—	124	124	—	—	—	—	203
102	—	65	—	—	65	65	—	—	—	—	326
—	—	—	—	—	286	286	—	—	—	—	286
—	—	—	—	—	—	—	—	—	—	—	1,026
—	—	—	—	—	—	—	—	—	—	—	1,769
—	—	—	—	—	696	696	—	—	—	—	968
—	—	—	—	—	1,004	1,004	—	—	—	—	1,464
—	—	—	—	—	—	—	—	—	—	—	265
—	—	—	—	—	207	207	—	—	—	—	642
83	—	—	—	—	326	326	—	—	—	—	790
1,001	—	—	—	—	—	—	—	—	—	—	1,001
489	—	—	—	—	29	29	62	—	—	—	3,398
—	—	—	—	—	—	—	—	—	—	—	334
—	—	—	—	—	—	—	—	—	—	—	2,241
—	—	—	—	—	—	—	—	—	—	—	993
1,649	—	—	—	—	—	—	—	—	—	—	1,649
76	—	—	—	—	—	—	—	—	—	—	1,594
—	—	—	—	—	—	—	—	—	—	—	812
54	—	—	—	—	—	—	—	—	—	—	2,048
—	—	—	—	—	—	—	—	—	—	—	533
—	—	—	—	—	—	—	—	—	—	—	1,752
7,606	9,072	2,449	532	911	2,123	3,566	—	322	15,618	—	47,115
87	384	—	—	852	—	852	—	—	116	—	7,141
—	1,098	—	—	—	—	—	—	—	—	—	1,174
—	529	1,015	—	—	—	—	—	330	—	—	1,874
1,696	1,953	1,627	1,150	8,342	247	9,739	709	188	84	5,095	28,418
—	257	4,670	105	—	—	105	—	—	902	—	5,934
895	1,033	827	—	—	—	—	—	—	3,980	—	6,771
1,653	2,675	—	—	—	—	—	—	—	—	—	4,785
—	—	1,046	—	—	—	—	—	—	—	—	1,046
511	—	1,033	—	—	—	—	—	—	442	—	1,986
772	—	69	—	—	—	—	—	—	—	—	903
2,461	—	652	—	—	—	—	—	—	—	—	3,113
1,145	—	47	—	—	—	—	—	—	—	—	1,511
892	279	319	—	—	—	—	946	—	—	—	3,589
—	—	413	—	47	—	47	257	—	—	—	717
801	—	—	—	—	—	—	—	—	—	—	801
2,012	2,463	942	—	—	—	—	—	72	—	—	5,489
4,136	—	—	—	—	—	—	—	—	—	—	4,136
—	—	—	—	—	—	—	—	—	518	152	670
—	—	—	—	—	—	—	—	—	—	2,367	2,367
—	—	—	—	—	—	—	—	72	1,338	1,265	2,675
2,411	—	—	—	—	—	—	—	—	—	—	2,411
—	1,012	4,404	—	—	—	—	—	2,567	2,338	—	10,321
—	10,169	—	—	—	—	—	—	—	—	—	12,645
1,917	—	—	—	—	—	—	—	—	—	—	2,341
—	—	—	—	—	—	—	—	—	—	—	2,052
—	323	—	—	—	—	—	—	—	—	—	939
192	—	—	—	—	—	—	—	—	—	—	413
—	221	—	—	—	—	—	—	—	—	—	1,983
—	—	—	—	—	—	—	—	—	—	—	269
946	2,772	431	—	—	—	—	—	—	—	—	4,287

TABLE 5.—*Acreage of map units in*

Map unit	Southeastern Alaska	South Central Alaska Mountains	Cook Inlet-Susitna Lowland	Alaska Peninsula and Southwestern Islands	Copper River Plateau	Alaska Range	Interior Alaska Lowlands				
							Koyukuk-Innoko Lowland	Kanuti Flats	Tanana-Kuskokwim Lowland	Yukon Flats	Total
IR7	—	—	—	—	—	—	243	—	—	—	243
IR8	—	—	—	—	—	—	—	—	268	—	268
IR9	—	14	—	—	283	—	—	—	—	—	—
IR10	—	—	—	—	44	84	—	—	878	—	878
IR11	—	315	—	—	398	91	—	—	36	—	36
IR12	—	—	—	—	—	672	—	—	33	—	33
IR13	—	—	—	—	—	58	—	—	134	—	134
IR14	—	—	—	—	—	—	—	—	—	—	—
IU1	—	—	—	—	—	—	—	—	—	—	—
IU2	—	45	—	—	668	—	—	—	—	—	—
IU3	—	2,614	—	—	498	167	—	—	—	—	—
LF	—	—	—	18	—	—	—	—	—	—	—
MA1	—	—	—	—	—	—	—	—	—	—	—
MA2	—	—	—	—	—	—	—	—	—	—	—
MA3	—	—	—	—	—	—	—	—	—	—	—
MB1	—	—	—	—	—	—	—	—	—	—	—
MB2	—	—	—	—	—	—	—	—	—	—	—
RM1	8,361	21,174	44	6,730	—	12,528	—	—	—	—	—
RM2	—	—	—	—	—	—	—	—	—	—	—
SH1	301	—	—	—	—	—	—	—	—	—	—
SO1	—	—	2,926	—	—	—	—	—	—	—	—
SO2	—	—	453	—	—	—	—	—	—	—	—
SO3	—	—	—	—	—	—	—	—	344	—	344
SO4	—	—	261	—	—	—	—	—	—	—	—
SO5	—	29	457	—	—	—	—	—	—	—	—
SO6	—	605	—	—	—	—	—	—	—	—	—
SO7	—	—	—	—	—	—	—	—	—	—	—
SO8	—	—	127	—	—	257	—	—	—	—	—
SO9	—	—	374	—	—	—	—	—	—	—	—
SO10	—	1,047	392	—	221	—	—	—	—	—	—
SO11	—	—	—	185	—	—	—	—	—	—	—
SO12	—	1,941	—	—	—	—	—	—	—	—	—
SO13	—	—	119	—	—	624	—	—	—	—	—
SO14	—	—	—	—	—	—	—	—	—	—	—
SO15	—	—	—	18	457	109	—	—	366	—	366
SO16	—	—	—	—	2,626	—	—	—	—	—	—
SO17	—	—	—	—	402	1,130	—	—	—	—	—
SO18	9,915	76	—	—	—	—	—	—	—	—	—
Total land	18,743	30,043	7,333	22,653	8,999	18,962	8,760	1,129	12,238	8,432	30,559
Water	8	134	222	816	369	12	887	44	804	533	2,268
TOTAL	18,751	30,177	7,555	23,469	9,368	18,974	9,647	1,173	13,042	8,965	32,827

ter, the soils consist of dark gray silty and sandy waterlaid sediment about 10 to 30 inches (25 to 75 cm) thick over gravel, sand, and cobblestones. A few thin lenses and small pockets of organic material are commonly buried in the waterlaid sediment. The water table is normally more than 3 feet (90 cm) below the surface, but in places the soils are susceptible to occasional flooding. See *8b* in table 6.

Typic Cryorthods, very gravelly, nearly level, (10 percent) are well drained soils on terraces slightly higher than the general level of the plains. The vegetation is a forest of Sitka spruce. Beneath a mat of forest litter, the soils formed in a shallow mantle of silt loam or sandy loam over very gravelly outwash. They have a thin albic horizon and a spodic horizon about 6 to 12 inches (15 to 30 cm) thick. See *124b* in table 6.

Humic Cryorthods, very gravelly, hilly to steep, (10 percent) are well drained soils on moraines near the adjacent mountains. Slopes are generally short and range from 12 to 45 percent. The vegetation is forest dominated by Sitka spruce. The soils formed in friable glacial till that ranges from very gravelly silt loam to very gravelly sandy loam. Under a mat of forest litter, they have a thin albic horizon and a spodic horizon about 10 to 24 inches (25 to 60 cm) thick. The upper part of the spodic horizon is black or dark reddish brown, and lower parts are brown to yellowish brown. The underlying till is commonly olive gray. See *131a* in table 6.

Other components (10 percent):

Typic Cryorthods, sandy, hilly to steep, are well drained soils on stabilized dunes under Sitka spruce forest or alder brush. See *123a* in table 6.

Typic Cryopsamments, sandy, hilly to steep, are

major land resource areas—Continued

Kusko-kwim High-lands	Interior Alaska High-lands	Norton Sound High-lands	Western Alaska Coastal Plains and Deltas				Bering Sea Islands	Brooks Range	Arctic Foothills	Arctic Coastal Plain	Total acreage
			Selawik-Kobuk Delta	Yukon-Kusko-kwim Delta	Bristol Bay Coastal Plain	Total					
—	200	120	—	—	—	—	—	—	—	—	563
—	—	—	—	—	—	—	—	—	—	—	268
—	109	—	—	—	—	—	—	—	—	—	406
—	—	—	—	—	—	—	—	—	—	—	1,006
—	—	—	—	—	—	—	—	—	—	—	840
1,533	12,023	—	—	—	—	—	—	—	—	—	14,261
54	1,805	585	—	—	—	—	—	—	—	—	2,636
—	2,157	—	—	—	—	—	—	—	—	—	2,157
1,033	—	—	—	—	—	—	—	—	—	—	1,033
707	370	7,842	—	130	—	130	250	—	174	—	10,186
4,467	—	1,287	—	—	—	—	224	—	—	—	9,257
—	—	123	—	—	—	—	—	—	—	—	141
—	—	—	—	—	—	—	—	—	—	3,444	3,444
—	—	—	—	—	—	—	—	1,033	—	—	1,033
—	—	—	—	—	—	—	—	1,403	793	—	2,196
—	370	—	—	—	—	—	—	—	—	—	370
—	—	—	—	—	—	—	174	696	4,898	—	5,768
959	174	—	—	18	—	18	7	17,731	47	—	67,773
—	924	953	—	—	—	—	—	4,745	240	—	6,862
—	—	—	—	—	—	—	—	—	—	—	301
—	—	—	—	—	—	—	—	—	—	—	2,926
—	—	—	—	—	—	—	—	—	—	—	453
124	—	—	—	—	—	—	—	—	—	—	468
—	—	—	—	—	—	—	—	—	—	—	261
—	—	—	—	—	—	—	—	—	—	—	486
286	—	—	—	—	—	—	—	—	—	—	891
1,197	—	—	—	—	62	62	—	—	—	—	1,259
—	—	—	—	—	—	—	—	—	—	—	384
—	—	—	—	—	—	—	—	—	—	—	374
1,062	—	—	—	—	—	—	—	—	—	—	2,722
101	—	—	—	—	—	—	—	—	—	—	286
—	—	—	—	—	—	—	—	—	—	—	1,941
776	—	—	—	—	—	—	—	—	—	—	1,519
—	188	—	—	—	—	—	—	—	—	—	188
138	—	—	—	—	—	—	—	—	—	—	1,088
—	—	—	—	—	—	—	—	—	—	—	2,626
566	—	—	—	—	—	—	—	—	—	—	2,098
—	—	—	—	—	—	—	—	—	—	—	9,991
46,826	53,435	30,930	1,787	10,300	6,347	18,434	2,629	29,159	31,488	12,323	362,516
911	318	413	401	2,926	936	4,263	217	192	135	2,510	12,788
47,737	53,753	31,343	2,188	13,226	7,283	22,697	2,846	29,351	31,623	14,833	375,304

excessively drained soils on low partially stabilized dunes. Vegetation is mainly mosses, grasses, and shrubs. See *22* in table 6.

Typic Cryorthents, very gravelly, nearly level, are excessively drained soils on low terraces under cottonwood forest or willow and alder brush. See *12a* in table 6.

Typic Cryaquents, clayey, nearly level, are poorly drained soils on tidal flats. Vegetation is mainly sedges and rushes. See *1* in table 6.

Riverwash consists of frequently flooded sandy and gravelly areas on flood plains. See *144* in table 6.

EA2—Typic Cryaquents, sandy, nearly level association is in the following major land resource areas:

	Acres
170 Cook Inlet-Susitna Lowland	450,000
172 Copper River Plateau	83,000
Total	533,000

On the COOK INLET-SUSITNA LOWLAND the association occupies nearly level, poorly drained outwash plains at the terminus of large glaciers in the Alaska Range. The plains are braided with many meandering and shifting channels of glacier-fed streams. Narrow natural levees that are slightly higher than the general level of the plains border some of the larger streams. Periodic flooding is extensive, and coastal areas are frequently inundated by tidewater. Elevations on plains bordering Cook Inlet range from sea level to about 100 feet (30 m) and inland outwash plains are at an elevation near 1,000 feet (300 m). The soils are free of permafrost. They are in a cool maritime climate near the coast and a transitional climate characterized by a strong continental influence in the inland areas.

Most soils of the association in the Lowland consist of sandy glacial outwash, but a few formed in stratified silty and sandy sediment on natural levees, tidal sedi-

ment and dune sand near the coast, and very gravelly riverwash near some of the larger streams.

The dominant vegetation is sedges, mosses, willows, and other shrubs in wet areas. Cottonwood and some white spruce, alder, and tall willows cover areas that have better drainage.

The habitat is excellent for waterfowl and other wildlife that require wet areas. Largely because of flooding and a high water table, the dominant soils in the association have severe limitations for farming, forestry, and most engineering uses. The best construction sites are on well drained natural levees.

Principal components in the Cook Inlet-Susitna Lowland:

Typic Cryaquents, sandy, nearly level, (65 percent) consist of poorly drained sandy waterlaid material deposited on broad, nearly level plains by glacier-fed streams. Gradients are usually less than 1 percent. Flooding is frequent, and in periods between floods the water table is near the surface. The vegetation is mainly sedges, mosses, and low shrubs. Typically, these soils have a thin peaty surface mat over mottled, dark gray stratified sand. The sandy material commonly contains thin layers of fine gravel and is 2 feet (60 cm) to many feet thick over very gravelly sand. See *3a* in table 6.

Typic Cryofluvents, loamy, nearly level, (15 percent) are well drained soils on natural levees bordering major streams. They are slightly higher than the general level of the associated poorly drained soils. The soils consist of silty and sandy waterlaid sediment. Flooding is rare, and the water table is normally more than 4 feet (120 cm) below the surface. The vegetation is either a forest of cottonwood with a dense understory of alder and willow or a brushy stand of tall alder and willow. Typically, the soils have a thin mat of partially decomposed plant litter over dark gray stratified silt and fine sand that commonly contains buried pockets and lenses of organic matter. The stratified sediment is 2 to 5 feet (60 to 150 cm) thick over very gravelly sand. See *7a* in table 6.

Fluvaquentic Borohemists, nearly level, (15 percent) consist of very poorly drained peat that has accumulated in former lake basins and abandoned stream channels. The peat is mainly partially decomposed mosses and sedges. The water table is always at or near the surface. The vegetation is mainly sedges, mosses, and low shrubs. In a typical profile, a surface layer of coarse fibrous peat overlies easily crushed sedge and moss fibers layered with silty and sandy seams of volcanic ash. These peaty deposits are more than 5 feet (150 cm) thick over mineral material. See *35* in table 6.

Other components (5 percent):

Typic Cryorthents, very gravelly, nearly level, are excessively drained soils on terraces and flood plains. See *8b* in table 6.

Typic Cryaquepts, loamy, nearly level, are poorly drained soils in slight depressions in flood plains. See *55a* in table 6.

Riverwash consists of very gravelly, frequently flooded, nonvegetated areas bordering streams. See *144* in table 6.

Typic Cryopsamments, sandy, nearly level to rolling, are excessively drained soils on low dunes bordering flood plains and beaches. See *21* in table 6.

Tidal flats consist of nearly level, nonvegetated tidal sediment in coastal areas inundated by tides. See *147* in table 6.

Typic Cryaquents, clayey, nearly level, are nearly level, poorly drained, loamy and clayey tidal sediment that supports water-tolerant plants. See *1* in table 6.

In the COPPER RIVER PLATEAU this association occupies a broad, nearly level outwash plain braided with glacier-fed streams that form the headwaters of the Susitna River. The elevation is about 2,800 feet (850 m) above sea level. Flooding is frequent in most of the area. It is most likely to occur when exceptionally heavy precipitation coincides with a peak period of glacial outflow caused by warmer than normal temperatures.

Most soils of the association in this area consist of sandy and gravelly outwash material. Permafrost is usually deep or absent in this material but does occur in peat bogs and in silty soils on terraces.

The dominant vegetation is sedges, mosses, willows, dwarf birch, alder, and a few scattered stands of black spruce. In general, the habitat for wildlife is of fairly high quality and is used by a wide variety of species, including moose and caribou. Soils of the association are not suitable for crops or commercial timber and have severe limitations for roads and construction sites because of flooding and a high water table.

Principal components in the Copper River Plateau:

Typic Cryaquents, sandy, nearly level, (70 percent) are poorly drained soils on broad, nearly level plains braided with shifting stream channels. They consist of waterlaid sands over very gravelly outwash. Gradients are usually less than 1 percent. Flooding is frequent. Between floods the water table is near the surface. Permafrost is deep or absent. The vegetation is mainly sedges, willow, and low shrubs.

Typically, there is a thin surface layer of partially decomposed organic matter over mottled dark gray layers of fine, medium, and coarse sand. The stratified sand is generally 2 to 4 feet thick over loose very gravelly coarse sand. In places the soils have a thin mineral surface layer of mottled dark gray silt loam. See *3b* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level, (15 percent) are poorly drained soils on low terraces slightly above the level of braided parts of the outwash plain. The soils formed in a mantle of silty material over very gravelly or sandy outwash. They have a shallow permafrost table and are wet most of the summer and early in the fall. Flooding is rare and of short duration. The vegetation is mainly sedge tussocks, mosses, lichens, dwarf birch, willow, and scattered stands of stunted black spruce.

Typically, these soils have a thick peaty surface mat over nonacid, mottled gray silt loam. Depth to perennially frozen material is about 10 to 24 inches (25 to 60 cm) below the peaty surface mat. In some of the soils the silty material is as much as 35 percent gravel by volume. See *65a* in table 6.

Pergelic Cryofibrists, nearly level, (10 percent) con-

sist of very poorly drained fibrous peat that has accumulated in shallow basins of former ponds and lakes. The peat is perennially frozen at a shallow depth and is wet during the summer and early in the fall. The vegetation is mainly sedges and mosses.

Typically, the organic material is raw coarse sedge and moss fiber that is relatively undecomposed. The permafrost table is generally 10 to 20 inches (25 to 50 cm) below the surface. See *28* in table 6.

Other components (5 percent):

Riverwash consists of frequently flooded, very gravelly, stony and sandy areas bordering streams. See *144* in table 6.

Pergelic Cryaquepts, loamy, nearly level, are poorly drained soils on terraces and flood plains. They have a shallow permafrost table. See *72b* in table 6.

EA3—Typic Cryaquents, sandy, nearly level-Terric Sphagnofibrists, nearly level association is in the following major land resource areas:

	Acres
168 Southeastern Alaska	112,000
169 South Central Alaska Mountains	349,000
Total	461,000

This association occupies broad outwash plains bordering the Gulf of Alaska (fig. 6). The plains commonly extend inland to the steep foot slopes of coastal mountains. Although most of the association is nearly level and less than 100 feet (30 cm) above sea level, a few hilly areas are included. Sandy beaches, tidal marshes, and a few small deltas are along the coast.

Most of the plains consist of sandy waterlaid sediment and irregular areas of fibrous peat that has accumulated in shallow basins. The water table is

***Figure 6.*—Sandy Typic Cryaquents, Terric Sphagnofibrists, and Typic Sphagnofibrists on broad outwash plains wetted by glacial outflow. Soils in forested coastal dunes are sandy Typic Cryorthods. Controller Bay, east of Cordova.**

usually near the surface, and low areas are freqently flooded by streams that originate in steep watersheds in the adjoining mountains. Many of the streams are glacier fed and have a rapidly fluctuating water level. Scattered terraces and natural levees bordering some of the streams are made up of very gravelly material capped with a thin mantle of silty and sandy sediment. These areas are slightly above the general level of the plains and the water table is usually deeper than 4 feet (120 cm). Hilly sand dunes are common near the coast. A few moraines consisting of gravelly till occur near the mountains. The association is in a cool maritime climate. There is no permafrost.

The principal vegetation on outwash plains is sedges, mosses, and other aquatic plants of coastal meadows, interspersed with many dense patches of tall alder and willow brush. Forests of western hemlock and Sitka spruce occur on moraines, a few terraces, and most of the stabilized dunes. Stands of cottonwood are common on natural stream levees, and patches of grasses, forbs, willow, and alder are on active dunes and low beach ridges along the coast.

Largely because of a high water table and frequent flooding, the dominant soils have severe limitations for crops, roads, and most other types of intensive use or development. Many of the soils support coastal meadows that are used heavily by migratory birds as stopover areas and nesting sites. Although their total acreage is small, a few soils are suitable for forage crops and vegetables. These soils, which occur in small scattered areas on terraces and natural levees, are generally the best sites for roads and other types of development. The total acreage suitable for commercial forestry is small.

Principal components:

Typic Cryaquents, sandy, nearly level, (35 percent) consist of poorly drained sandy waterlaid sediment on nearly level plains. Gradients are usually less than 1 percent. Flooding is frequent, and the water table is usually near the surface. The vegetation is mosses, sedges, low shrubs, and patches of tall willow and alder brush. In a typical profile these soils have a thin peaty surface layer over mottled dark gray stratified sand. The sandy material commonly contains thin layers of fine gravel and is 2 to 4 feet (60 to 120 cm) thick over very gravelly sand. See *3a* in table 6.

Terric Sphagnofibrists, nearly level, (20 percent) consist of very poorly drained sphagnum peat that has accumulated in shallow depressions on the outwash plains. The peat is less than 60 inches (150 cm) thick over dark gray silty and sandy stratified sediment. The water table is always near the surface. Reaction is extremely acid. Frost seldom penetrates deeper than a few inches. The vegetation is sphagnum moss, sedges, and low shrubs. See *31* in table 6.

Typic Sphagnofibrists, nearly level, (15 percent) consist of very poorly drained sphagnum peat more than 63 inches (160 cm) thick. The peat is soft and spongy, and the water table is always near the surface. Frost seldom penetrates deeper than a few inches. The vegetation is mainly sphagnum moss, sedges, and low shrubs. See *30* in table 6.

Typic Cryofluvents, very gravelly, nearly level, (10 percent) are well drained soils on low terraces and natural levees. Gradients are usually less than 2 percent. The soils consist of about 10 to 20 inches (25 to 50 cm) of dark gray stratified silt and fine sand over loose very gravelly sand. The principal vegetation is a forest of Sitka spruce and western hemlock, but a few areas support stands of cottonwood and patches of tall brush. See *8a* and *8b* in table 6.

Typic Cryorthods, sandy, hilly to steep, (10 percent) are well to excessively drained soils on hilly dunes that border the flood plains of braided glacier-fed streams. Slopes are short and choppy, with gradients ranging from 12 to 45 percent. The soils formed in deep eolian sands that are usually capped with a thin mantle of silty loess. The principal vegetation is a forest of Sitka spruce and western hemlock. In a typical profile the soil has a thin surface mat of forest litter, a thin light gray silt loam surface layer, and dark reddish brown to brown sandy subsurface layers over grayish brown sand. See *123a* in table 6.

Other components (10 percent):

Typic Cryorthents, very gravelly, hilly to steep, are well drained soils on very gravelly and stony till moraines. The vegetation is either a forest of Sitka spruce and western hemlock or dense patches of tall alder and willow brush. See *13a* and *13b* in table 6.

Typic Cryaquents, loamy, nearly level, are poorly drained soils consisting of mottled, gray or greenish gray, stratified clay, silt, and fine sand on deltas and uplifted coastal plains. The vegetation is mainly sedges, mosses, and other aquatic plants. See *2a* in table 6.

Typic Cryorthents, very gravelly, nearly level, are excessively drained soils on very gravelly outwash plains and alluvial fans. Most areas are forested, but some areas near the coast support grasses, forbs, and shrubs. See *12a* in table 6.

Dune land consists of active dunes on hummocky areas bordering coastal beaches. See *141* in table 6.

Riverwash consists of frequently flooded sandy and gravelly areas along streams. See *144* in table 6.

Gravelly beaches consist of coarse material inundated by high tides. See *142* in table 6.

Tidal flats consist of marine sediment on coastal areas that are frequently inundated by tidewater. See *147* in table 6.

EA4—Typic Cryaquents-Typic Cryofluvents, very gravelly, nearly level association is in the following major land resource area:

	Acres
169 South Central Alaska Mountains	526,000

This association occupies outwash plains and alluvial fans between the foot slopes of coastal mountains and the northern coast of the Gulf of Alaska. Although large areas are nearly level and less than 100 feet (30 m) above sea level, a few hilly areas on dunes and moraines are included. The major streams are glacier fed and have broad flood plains braided with numerous channels. Many low areas are susceptible to frequent flooding, and a few areas along the coast are inundated by exceptionally high tides. The water table in these low areas is generally near the surface.

Most of the plains in the association consist of very gravelly outwash deposits capped with waterlaid sediment of variable thickness. Shallow basins on the

plains are commonly filled with peat. Stabilized dunes of eolian sand border some of the beaches and ports of large flood plains. Hilly moraines near the mountains consist mainly of very gravelly and stony till.

The association occurs in a cool maritime climate. Summers are cool, and winters are moderately cold. Precipitation, including snowfall, is heavy. The soils have no permafrost.

There are several principal types of vegetation in the association. Forests of Sitka spruce and western hemlock are dominant on the well drained soils on outwash plains, moraines, and stabilized dunes. Stands of cottonwood and dense patches of tall willow brush are common on soils bordering the rivers and streams. Soils with a very high water table usually support sedges, mosses, willow, and other aquatic plants. Grasses, forbs, and patches of willow grow on some of the sandy soils along the beaches.

Most areas of the association are within National Forest boundaries and are managed primarily for timber, wildlife, and recreation. A few areas outside of the National Forest are used for expanded municipal and industrial development. In these areas, some of the soils that occupy low positions have severe limitations for intensive uses because of flooding or high water tables.

Principal components:

Typic Cryaquents, very gravelly, nearly level, (30 percent) are poorly drained soils on low, nearly level areas of outwash plains and flood plains. The soils consist of 10 to 30 inches (25 to 75 cm) of mottled dark gray stratified silt loam and sand over loose very gravelly sand. The water table is usually near the surface, and areas near streams are frequently flooded. The principal vegetation is sedges, mosses, and low willows and other shrubs. See *4* in table 6.

Typic Cryofluvents, very gravelly, nearly level, (15 percent) occupy natural levees and terraces bordering flood plains. The soils have 10 to 30 inches (25 to 75 cm) of well drained dark gray silty and sandy waterlaid sediment containing black lenses and pockets of organic matter over coarse sand, gravel, and cobblestones. Normally, the water table is more than 3 feet (85 cm) below the surface, but many areas are susceptible to occasional flooding. The dominant vegetation is a forest of either cottonwood or Sitka spruce. See *8b* in table 6.

Typic Cryorthods, very gravelly, nearly level to rolling, (15 percent) are well drained soils on undulating to rolling moraines and nearly level, slightly elevated parts of outwash plains. The gradient generally ranges from 0 to 12 percent, but a few steeper slopes in hilly areas are included. The soils formed in loamy material over very gravelly till or outwash. The vegetation is a forest of Sitka spruce and western hemlock.

Typically under a mat of moss and forest litter, a thin layer of gray, leached silt loam overlies layers of dark reddish brown to yellowish brown silt loam and fine sandy loam. The loamy material is about 15 to 30 inches (38 to 75 cm) thick. On outwash plains the substratum is loose coarse sand, gravel, and cobblestones. On moraines the substratum ranges from very gravelly sand to very gravelly loam. Large stones and boulders are common on the moraines. See *124b* in table 6.

Terric Sphagnofibrists, nearly level, (15 percent) are very poorly drained organic soils in shallow basins of outwash plains. The water table is near the surface. The peat is derived chiefly from sphagnum moss and is 24 to 50 inches (60 to 125 cm) thick over sandy or loamy sediment. The vegetation is mainly mosses, sedges, and low shrubs. See *31* in table 6.

Typic Cryorthods, sandy, hilly to steep, (10 percent) are well and excessively drained soils on stabilized dunes. The gradient generally ranges from 12 to 45 percent, but a few undulating and rolling areas on low dunes along beaches are included. Typically, a thin gray leached surface horizon overlies dark reddish brown and yellowish brown horizons that developed in a few inches of silty loess over deep loose sand. The vegetation is a forest of Sitka spruce and western hemlock. See *123a* in table 6.

Other components (15 percent):

Typic Cryorthents, very gravelly, nearly level to steep, are well drained soils on outwash plains and hilly moraines near glaciers. See *12* and *13* in table 6.

Typic Sphagnofibrists, nearly level, are very poorly drained thick sphagnum moss peat in small depressions in moraines. See *30* in table 6.

Riverwash consists of very gravelly and sandy deposits along streams. See *144* in table 6.

Dune land consists of small undulating to hilly active sand dunes near beaches. See *141* in table 6.

Typic Cryaquents, clayey, nearly level, are marshes on low coastal plains and deltas. They are frequently inundated by tidewater. See *1* in table 6.

Gravelly beaches occur along the coast. See *142* in table 6.

EA5—Typic Cryaquents, very gravelly, hilly to steep-Rough mountainous land association is in the following major land resource area:

	Acres
169 South Central Alaska Mountains	292,000

This association occupies coastal areas of the Kenai Peninsula bordering Prince William Sound and islands in the western part of the Sound. Highest elevations are about 3,000 feet (915 m), but on the mainland the association borders large areas of high ice-covered mountains. The area has been subject to intense glaciation and exhibits features typical of recently glaciated landscapes, including deep narrow bays, steep valley walls that expose much bedrock, and thin moraine deposits in many places in the hills and valleys.

Sedges, mosses, and associated water-tolerant plants are dominant above 1,000 feet (300 m). Steep lower slopes are forested, but many gentle and moderate slopes, even at elevations close to sea level, support only water-tolerant vegetation. The principal trees in the forested areas are western hemlock, mountain hemlock, and Sitka spruce.

Soils under the treeless vegetation are poorly drained, and the water table is at or close to the surface. Many are organic soils (Histosols), but the most extensive poorly drained soils have only a relatively thin mat of organic material at the surface.

Both well drained mineral soils and poorly drained

organic soils occur in forested areas, but only a few forested areas contain timber of commercial size. Soils of this association have no agricultural potential. Steep slopes, bedrock, and a high water table severely limit most kinds of construction.

Principal components:

Typic Cryaquents, very gravelly, hilly to steep, (25 percent) are poorly drained soils on moraines at elevations ranging from sea level to more than 1,000 feet (300 m) in areas above tree line. The topography is commonly irregular and includes many rock outcrops. The soils consist of partially to nearly completely decomposed sedge peat less than 16 inches (40 cm) thick over firm unweathered glacial till containing many stones and boulders. Thin layers of volcanic ash commonly occur in the organic mat. Both the organic material and the underlying glacial till are strongly acid. The till is normally only a few feet thick over bedrock. See *5* in table 6.

Rough mountainous land (20 percent) consists of glacially scoured bedrock of steep valley sides and higher peaks. A few trees grow in crevices in the rock at lower elevations, and some areas are covered with a thin layer of peat. Most of the area is barren. See *145* in table 6.

Terric Cryohemists, nearly level to rolling, (10 percent) occupy mostly gently sloping to moderately sloping hillsides and terraces between sea level and elevations of several hundred feet. The vegetation is dominantly sedges and mosses. The soils consist mostly of partially decomposed sedge peat 20 to 50 inches (50 to 125 cm) thick over firm very stony silt loam (glacial till), but the upper 8 to 12 inches (20 to 30 cm) of the peat commonly is fibrous moss or sedge peat. Two or three layers of silty volcanic ash occur in the peat. In places a thin layer of highly decomposed peat is directly above the firm glacial till substratum. See *40* in table 6.

Typic Cryofolists, hilly to steep, (10 percent) occupy steep foot slopes and old beach ridges in forested areas. The principal trees are western hemlock and Sitka spruce. The soils consist of 5 to 20 inches (8 to 50 cm) of acid forest litter over bouldery talus deposits or rounded gravel and stones. Interstices between the pebbles, stones, and boulders may be partially filled with woody organic material. Surfaces of some of the coarse fragments are stained with organic matter. See *32* in table 6.

Humic Lithic Cryorthods, very gravelly, hilly to steep, (10 percent) are well drained soils on very steep hillsides. They support a forest of western hemlock and Sitka spruce. Below the forest litter they are 5 to 20 inches (8 to 50 cm) thick over bedrock. The thin albic horizon and the black to dark reddish brown spodic horizon formed in very gravelly silty material. Reaction is very strongly or extremely acid. Outcrops of bare rock are common in areas of these soils, which in many places are closely associated with Lithic Cryofolists. See *132* in table 6.

Lithic Cryofolists, hilly to steep, (5 percent) occur in association with Humic Lithic Cryorthods mainly on steep slopes with many rock outcrops and on isolated rock outcrops in areas dominated by Typic Cryaquents or Terric Cryohemists. They commonly support a forest of Sitka spruce and western hemlock, but some isolated rock outcrops are covered only by shrubs. The soils consist of 6 to 20 inches (15 to 50 cm) of forest litter that directly overlies bedrock or overlies a very thin gravelly horizon above the bedrock. The lower part of the litter may be highly decomposed. In general, the soils are extremely acid. See *33* in table 6.

Typic Cryorthents, very gravelly, nearly level to rolling, (5 percent) occupy parts of outwash plains and flood plains. They support, for the most part, thickets of alder and willow, but clumps of Sitka spruce also occur. The soils consist of about 10 inches (25 cm) of stratified gray sand and silt loam over a thick substratum of very gravelly sand. They are occasionally inundated. Other Typic Cryorthents, not listed separately, occupy hilly moraines adjacent to receding glaciers and consist entirely of gray very gravelly or stony silt loam. See *12a* in table 6.

Humic Cryorthods, very gravelly, hilly to steep, (5 percent) are well drained soils on friable glacial till, commonly on steep hillsides. They support a forest dominated by Sitka spruce and western hemlock. Beneath a mat of forest litter they have a thin gray albic horizon and a spodic horizon that is black or dark reddish brown in the upper part and grades with depth to brown or yellowish brown. The thickness of the spodic horizon ranges from 8 to 24 inches (20 to 60 cm) in recently exposed till in the older glacial till. The underlying unaltered glacial till ranges from olive to bluish gray. The soil is very gravelly silt loam to very gravelly loam in all horizons. In places the deposit of glacial till is thin, and consolidated bedrock occurs at depths as shallow as 20 inches (50 cm). The soils are normally extremely acid near the surface but become less strongly acid with depth. See *131a* in table 6.

Cryic Fragiaquods, very gravelly, nearly level to steep, (5 percent) are somewhat poorly drained soils on lower hillsides that are subject to seepage. They support a forest dominated by slow-growing western hemlock. The soils, despite their wetness, have thin albic and spodic horizons. The spodic horizon is underlain by a very firm gravelly or stony fragipan formed in glacial till. Seep water flows above this layer almost continuously. Textures range from very gravelly loam to very gravelly silt loam. The soils are very strongly acid. See *114* in table 6.

Other components (5 percent):

Lithic Cryohemists, hilly to steep, occur mostly above tree line. They consist of partially decomposed sedge peat 10 to 40 inches (25 to 100 cm) thick over bedrock. The vegetation is dominantly sedges. See *38* in table 6.

Typic Sphagnofibrists, nearly level to rolling, cover rolling moraine hills at low elevations. They consist of 60 inches (150 cm) or more of sphagnum peat over firm glacial till. The vegetation is dominantly mosses, sedges, and other water-tolerant plants. See *30* in table 6.

EF1—Typic Cryofluvents-Typic Cryaquents, loamy, nearly level association is in the following major land resource areas:

		Acres
169	South Central Alaska Mountains	51,000
170	Cook Inlet-Susitna Lowland	319,000
175	Kuskokwim Highlands	236,000
178	Western Alaska Coastal Plains and Deltas	83,000
	Total	689,000

This association occupies broad, nearly level flood plains and low terraces bordering some of the major rivers in south central and southwestern Alaska. Sharply contrasting types of vegetation, meandering sloughs, and many stream scars are prominent features of the landscape. Low parts of the association are subject to frequent or occasional flooding, but some areas on terraces are rarely flooded.

The dominant soils in the association consist of well drained stratified waterlaid sediment of variable thickness over a substratum of gravel, sand, and cobblestones. The water table is high in other soils, including the scattered muskegs of fibrous peat. Most of the well drained soils on terraces are forested with either cottonwood or white spruce and paper birch. These forests are commonly interspersed with dense patches of tall brush growing on poorly drained or frequently flooded soils and with muskegs that support mosses, sedges, low shrubs, and stands of black spruce.

The association occurs in a transitional climatic zone and is generally free of permafrost. Temperature and precipitation in most areas are between those of the cool maritime and cold continental zones.

Although many soils in the association have severe limitations for intensive use and development because of flooding, a high water table, or severe streambank erosion, some of the well drained soils on terraces support commercial stands of timber and are suitable for cultivation. Access to these soils is often difficult because many areas are isolated by sloughs, muskegs, and frequently flooded land. The only farming and logging is in a few areas near the Susitna and Knik Rivers that are accessible by road. Except for these areas and a few small settlements along the rivers, nearly all of the association is undeveloped and provides an exceptionally high quality of habitat for a large variety of wildlife.

Principal components:

Typic Cryofluvents, loamy, nearly level, (35 percent) are well drained soils on higher parts of flood plains and low terraces. Some areas are on river islands separated from the mainland by narrow sloughs and channels. The water table is normally more than 4 feet (130 cm) below the surface, but low areas are subject to occasional flooding. Most of the soils support forests dominated by either cottonwood or white spruce and paper birch. Under a thin mat of forest litter the soil is dark gray stratified silt loam and fine sandy loam 25 to 60 inches (65 to 150 cm) thick over loose coarse sand, gravel, and cobblestones. The loamy sediment commonly contains buried lenses of organic material. See *7a* and *7c* in table 6.

Typic Cryaquents, loamy, nearly level, (30 percent) consist of waterlaid loamy sediment deposited in slight depressions in flood plains and terraces. The soils are poorly drained, have a high water table, and are subject to frequent flooding. They support forests of black spruce and dense patches of tall alder and willow brush. Under a peaty surface mat 3 to 16 inches (8 to 40 cm) thick, the soil is mottled dark gray or dark greenish gray stratified silty clay loam and fine sandy loam that is 25 to 60 inches (65 to 150 cm) thick over very gravelly deposits. See *2a* and *2b* in table 6.

Typic Cryaquents, sandy, nearly level, (15 percent) are poorly drained sandy soils on stream-scarred flood plains and other low, frequently flooded areas. Between floods the water table is near the surface. The vegetation is sedges, mosses, shrubs, and forests of black spruce. The soils consist of a peaty surface layer 3 to 16 inches (8 to 40 cm) thick over dark gray waterlaid sand. The sandy sediment contains thin lenses of silty material and is 25 to 60 inches (65 to 150 cm) thick over very gravelly deposits. See *3a* and *3b* in table 6.

Sphagnic Borofibrists, nearly level, (10 percent) consist of very poorly drained, extremely acid fibrous peat that has accumulated in depressions in terraces. The vegetation is mainly mosses, sedges, and shrubs, but some areas support stands of stunted black spruce. The water table is usually near the surface. Under a mat of live moss the soil consists of more than 60 inches (150 cm) of very dark brown to dark yellowish brown coarse sphagnum moss fibers. At depths greater than 24 inches (60 cm) the moss fibers are commonly interbedded with layers of fibrous sedge peat. See *25* in table 6.

Other components (10 percent):

Histic Cryaquepts, loamy, nearly level, are poorly drained and have a thick peaty surface mat over gray mottled silt loam sediment. They occupy narrow drainageways and areas bordering muskegs. Some of the soils are very stony. The vegetation is mosses, sedges, alder, willow, and scattered forests of black spruce. See *62* in table 6.

Typic Cryorthents, very gravelly, nearly level, are excessively drained soils on low terraces bordering streams. Some areas are susceptible to flooding. The principal vegetation is a cottonwood forest. See *12a* and *12c* in table 6.

Typic Cryorthods, loamy, nearly level to rolling, are deep, well drained silt loams on older parts of river terraces. Slopes are mostly nearly level to undulating. The soils support forests of white spruce, paper birch, and cottonwood. See *120* in table 6.

Riverwash consists of very gravelly and sandy deposits along streams. These areas have little or no vegetation. See *144* in table 6.

EF2—Typic Cryofluvents-Histic Pergelic Cryaquepts, loamy, nearly level association is in the following major land resource area:

	Acres
174 Interior Alaska Lowlands	1,472,000

This association occupies broad flood plains and low terraces of the Yukon and Porcupine Rivers in the eastern part of the Yukon Flats. Most of the area is strongly patterned with low natural levees along former and existing stream courses separated by depressions, lakes, oxbow sloughs, and relief channels of major rivers. The elevation is between 400 and 500 feet (120 and 150 m) above sea level.

On levees and terraces, under forests of white spruce, cottonwood, and paper birch, the soils are generally well drained and consist of dark gray silty and sandy, nonacid to calcareous waterlaid sediment. Permafrost, if present, is very deep. In depressions between the levees, the dominant soils are poorly drained and have a shallow permafrost table. They support either a forest of black spruce or a cover of willows, sedges, mosses, and low shrubs. Areas of very poorly drained fibrous peat with a shallow permafrost table

occur in depressions under vegetation dominated by sedges and mosses.

A high proportion of soils in the association are subject to periodic flooding, and soils bordering the rivers are susceptible to streambank erosion. Floods most commonly occur in spring as a result of ice jams that block or restrict the flow of major rivers.

Though well drained soils on natural levees may be susceptible to flooding, most are suitable for small grain, forage crops, and adapted vegetables because floods normally subside well before the spring planting season and are rare or of short duration in the summer growing season. The well drained soils also support scattered stands of white spruce forest suitable for commercial use. The poorly drained soils have little potential for either agriculture or forestry. Largely because of periodic flooding or permafrost, soils of the association generally have severe limitations for construction. Most provide habitat for a wide variety of wildlife, especially migratory waterfowl that use the wet areas for nesting.

Principal components:

Typic Cryofluvents, loamy, nearly level, (50 percent) are well drained soils on natural levees and low terraces bordering former and existing stream courses. The permafrost table, if present, is very deep. The vegetation is typically a forest of white spruce, cottonwood, and paper birch, though some stands have been destroyed by recent forest fires. Most of the soils are occasionally flooded for short periods during spring breakup because of ice-jammed rivers. A few soils on the slightly higher levees or terraces, however, commonly escape all but the most severe floods. Soils bordering the rivers are susceptible to streambank erosion.

Typically, beneath a thin mat of partially decomposed plant litter, the soils consist of gray, stratified silty and sandy, nonacid to calcareous sediment 40 inches (100 cm) to many feet thick over sand and gravel. Pockets and streaks of organic material are usually buried in the sediment. See *7a* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level, (25 percent) are poorly drained soils with a shallow permafrost table in slight depressions and meander scars. They support either black spruce forest, patches of willow brush, or a cover of mosses, sedges, and low shrubs. In spring, and occasionally in summer, soils have a thick peaty surface mat over mottled gray loamy sediment that is calcareous at some depth. The permafrost table is usually less than 16 inches (40 cm) below the organic mat. See *65a* in table 6.

Pergelic Cryofibrists, nearly level, (15 percent) consist of very poorly drained peat in depressions and former lake basins under a cover of mosses and sedges. Typically, beneath a mat of living vegetation, the peat consists of dark brown coarse sedge and moss fibers. Depth to permafrost is usually less than 20 inches (50 cm). See *28* in table 6.

Pergelic Cryaquepts, loamy, nearly level, (10 percent) are poorly and somewhat poorly drained soils commonly in slight depressions in low terraces and levees. The vegetation is dominantly willows and grasses. Typically, beneath a thin peaty surface mat, the soils consist of mottled, gray and dark grayish brown loamy sediment that is calcareous at some depth. Depth to permafrost is about 20 to 40 inches (50 to 100 cm) below the mineral surface. See *72a* in table 6.

EO1—Typic Cryorthents, loamy, nearly level to rolling association is in the following major land resource area:

	Acres
170 Cook Inlet-Susitna Lowland	229,000

This association occupies broad terraces and moraines in parts of the Matanuska Valley in south central Alaska (fig. 7). Part of the braided flood plain of the glacier-fed Matanuska River is included. Elevations range from about 50 feet (11 m) above sea level on the flood plains near Knik Arm of Cook Inlet to 1,000 feet (300 m) near the mountains. Most of the bedrock is under thick deposits of very gravelly and sandy glacial drift. These deposits are capped with a mantle of loess, which is silty and very fine sandy material blown from barren areas on the nearby flood plains. Small increments of fresh loess are added each year by strong winds. Fine lenses of volcanic ash occur in the loess.

This association is the most highly developed farming area in Alaska. Dairying and vegetable production are the major farm enterprises. The principal crops are hay, barley, oats, potatoes, cabbage, lettuce, carrots, and peas. The natural vegetation on well drained soils that have not been cleared for farming is a forest dominated by paper birch and white spruce. Stands of cottonwood are common on the low terraces bordering flood plains, and forests of black spruce occupy some of the poorly drained soils. Some of the timber is harvested for commercial use. Parts of the area are being developed for residential sites.

Principal components:

Typic Cryorthents, loamy, nearly level to rolling, (40 percent) are well drained soils on terraces and low moraines, generally within a few miles of broad flood plains. The soils receive small increments of fresh loess each year. They consist of streaked very dark grayish brown and dark brown silt loam and very fine sandy loam about 25 to 60 inches (65 to 150 cm) thick over loose coarse sand, gravel, and cobblestones. The natural vegetation is a forest of paper birch and white spruce. Many of the soils have been cleared for cultivation or other use. See *10a* in table 6.

Typic Cryorthents, very gravelly, nearly level to rolling, (20 percent) are well drained soils, formed in shallow silty loess, that occupy high terraces and rolling moraines that are generally more distant from large flood plains than the deeper loamy soils of the association. The soils receive small increments of fresh loess each year. They consist of streaked gray and dark brown silt loam about 15 to 25 inches (40 to 65 cm) thick over very gravelly drift. A forest of paper birch and white spruce is the dominant vegetation in areas that have not been cleared for cultivation. See *12a* in table 6.

Typic Cryorthents, very gravelly, hilly to steep, (15 percent) are well drained soils on moraine hills and steep terrace escarpments. They consist of streaked gray and dark brown silty loess about 15 to 25 inches

Figure 7.—Loamy Typic Cryorthents on broad terrace of Matanuska River near Palmer. This is Alaska's most highly developed farming area. Windbreaks are necessary because of strong winds. Shallower Typic Cryorthents occur on higher terraces and moraines at left.

(40 to 65 cm) thick over very gravelly glacial drift. The natural vegetation is a forest dominated by paper birch. See *13b* in table 6.

Typic Cryofluvents, loamy, nearly level, (5 percent) occupy low terraces bordering flood plains. In places they are susceptible to occasional flooding. The soils consist of dark gray stratified silt loam and fine sandy loam 25 to 60 inches (65 to 150 cm) thick over loose coarse sand, gravel, and cobblestones. A forest of either paper birch and white spruce or cottonwood is the dominant vegetation in areas that have not been cleared for cultivation or other uses. See *7a* in table 6.

Typic Cryaquepts, loamy, nearly level, (5 percent) are poorly drained soils in slight depressions and drainageways in terraces and low moraines. The soils commonly have a high water table and receive seepage or runoff from higher areas. They have a mottled dark gray cambic horizon formed in 25 to 60 inches (65 to 150 cm) of silt loam to silty clay loam over very gravelly glacial drift. The vegetation is mainly black spruce, alders, willows, and grasses. See *55a* in table 6.

Typic Cryorthods, very gravelly, hilly to steep, (5 percent) are well drained shallow soils on high moraines near mountain foot slopes. The soils have a thin albic horizon and a reddish brown to brown spodic horizon formed in a mantle of loess about 10 to 15 inches (25 to 40 cm) thick over very gravelly drift. They support forests of paper birch and white spruce. See *125b* in table 6.

Sphagnic Borofibrists, nearly level, (5 percent) are very poorly drained soils that consist of coarse fibrous peat in depressions and shallow basins. The peat is more than 60 inches thick over mineral sediment. It is derived chiefly from sphagnum moss in the upper part and layered sphagnum moss and sedges in the lower part. The water table is usually near the surface. The vegetation is mainly black spruce, mosses, sedges, and low shrubs. See *25* in table 6.

Other components (5 percent):

Typic Cryaquents, loamy, nearly level, are poorly drained soils along drainageways and in low areas on flood plains. They consist of stratified silty and sandy sediment. See *2a* in table 6.

Histic Cryaquepts, loamy, nearly level, are poorly drained soils in depressions. They have a thick peaty surface mat over mottled gray silt loam. See *62* in table 6.

Humic Cryaquepts, loamy, nearly level, are poorly drained soils in seepage areas. They consist of black mucky silt loam over a mottled gray substratum. See *70* in table 6.

EO2—Typic Cryorthents, very gravelly, hilly to steep-Typic Cryohemists, nearly level to rolling association is in the following major land resource areas:

	Acres
168 Southeastern Alaska	54,000
169 South Central Alaska Mountains	606,000
Total	660,000

The association occupies moraines close to steep mountains and large glaciers in areas near the north coast of the Gulf of Alaska. Sharply contrasting heavily forested hills and wet treeless sloping valleys and depressions are characteristic of the landscape. The moraines consist of very stony and gravelly till with large boulders on the surface. Sloping valleys and depressions between the hills are strongly affected by seepage, which has favored the accumulation of peaty material derived from sedges, mosses, and other water-tolerant plants. Elevations range from slightly above sea level near the coast to about 1,000 feet (300 m) on the hilltops. The areas have a cool maritime climate with heavy precipitation, including snowfall. Summers are cool, and winters are relatively mild. There is no permafrost. The major soils have severe limitations for intensive use, but many of the areas are suitable for forestry, wildlife habitat, and recreation.

Principal components:

Typic Cryorthents, very gravelly, hilly to steep, (50 percent) are well drained soils on moraines near large glaciers. Slopes are short and choppy and range from about 12 to 45 percent. Under a surface mat of moss and forest litter the soils consist of olive gray glacial till that ranges from very gravelly loam to very gravelly silt loam. The till commonly contains many cobblestones and boulders. The vegetation is a forest of Sitka spruce. See *13a* and *13b* in table 6.

Typic Cryohemists, nearly level to rolling, (25 percent) consist of very poorly drained peat in valleys and in depressions in the moraines. They receive seepage from adjoining slopes, and the water table is usually near the surface. The peat is more than 50 inches (125 cm) thick and consists of dark brown to dark yellowish brown partially decomposed sedge fibers. The principal vegetation is sedges, mosses, and low shrubs. See *37* in table 6.

Terric Cryosaprists, nearly level to steep, (15 percent) are very poorly drained soils in seepage areas on the slopes of moraines. Gradients range from about 3 to 20 percent. Under a thick mat of moss and forest litter, the soils consist of black, finely divided mucky peat about 16 to 50 inches (40 to 125 cm) thick over mottled gray very gravelly and stony till. The water table is usually near the surface. The soils commonly support a forest dominated by western hemlock. See *43* in table 6.

Typic Cryorthods, very gravelly, hilly to steep, (10 percent) are well drained soils on older parts of moraines. Under a surface mat of partially decomposed moss and forest litter, they have a thin albic horizon and a spodic horizon that range from very gravelly sandy loam to very gravelly silty clay loam. The spodic horizon is about 10 to 18 inches (25 to 45 cm) thick. Colors grade from dark reddish brown in the upper part to dark yellowish brown in the lower part. The underlying unaltered till is typically olive gray and contains many stones and boulders. The soils commonly support a forest dominated by Sitka spruce. See *125a* and *125b* in table 6.

EO3—Pergelic Cryorthents-Typic Cryochrepts, very gravelly, hilly to steep association is in the following major land resource area:

	Acres
176 Interior Alaska Highlands	842,000

This association occupies an area of low mountains south of the Porcupine River, along the Canadian border. The mountains have flat tops and strongly sloping to steep sides (fig. 8). Below are foothills with long moderate to strong slopes and rounded shoulders. There are many drainageways that are narrow in the mountains and broader at lower elevations. A few small lakes are in the wider valley bottoms. Elevations generally are between 1,000 feet (300 m) and 3,000 feet (900 m), but the highest ridges reach 3,500 feet (1,050 m). Weathered limestone is exposed at higher elevations, and talus and rubble mantle the lower mountainsides. A thin layer of loess covers the gravelly material on lower slopes.

Below 2,500 feet (750 m) on steep slopes the vegetation is dominantly white spruce, shrubs, and grasses. Low shrubs, forbs, grasses, sedges, and lichens occupy higher ridges and steep mountainsides. Long foot slopes and broad drainageways have a dense cover of black spruce, shrubs, and sedge tussocks. White spruce and cottonwood forests cover levees along the major rivers. Areas of recent fires have a cover of alder, willows, young white spruce, grasses, and associated shrubs and forbs.

This area is not suitable for cultivation or commercial forestry, but has some potential for grazing. Steep slopes, wetness, and frost action limit its use for most construction purposes. The vegetation provides habitat for caribou, small mammals, and birds.

Principal components:

Pergelic Cryorthents, very gravelly, hilly to steep, (35 percent) occupy the steep upper slopes of mountains above 2,500 feet (750 m). They support a sparse cover of low shrubs, forbs, grasses, sedges, and lichens. Some rocky ridges, peaks, and unvegetated talus slopes are included.

Typically, below a thin black mat of well decomposed organic matter, these soils have a thin surface layer of very dark brown very gravelly silt loam over dark brown or olive brown very gravelly silt loam. Generally these soils are calcareous. Permafrost occurs

Figure 8.—Very gravelly Pergelic Cryorthents on high ridges under shrubby alpine vegetation and very gravelly Typic Cryochrepts on steep south-facing slopes at lower elevations under a white spruce forest. Histic Pergelic Cryaquepts are dominant in valley bottoms.

at a depth greater than 3 feet (90 cm). In places the soil is shallow over bedrock. See *20* in table 6.

Typic Cryochrepts, very gravelly, hilly to steep, (35 percent) are brown soils at elevations lower than 2,500 feet (750 m) on south-facing slopes. They support either a forest of white spruce mixed with paper birch or a cover of low shrubs and grasses. The soils are nonacid but are not calcareous.

Typically, below a very thin mat of partially decomposed organic matter, these soils have a thin dark grayish brown silt loam surface layer, a somewhat thicker dark yellowish brown silt loam subsoil, and a brown very gravelly silt loam substratum. See *86* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (25 percent) are poorly drained soils in valley bottoms and on concave side slopes of drainageways. They developed in thick nonacid loess or silty colluvium. They support a dense cover of sedge tussocks and shrubs. The soil, under a thick mat of partially decomposed sedge peat, is mottled dark gray silt loam. Permafrost is usually less than 16 inches (40 cm) below the mineral surface. Other Histic Pergelic Cryaquepts, not listed separately, occupy steep north-facing slopes of hills and low mountains. They formed in very gravelly or stony silt loam under a dense cover of mosses and shrubs. See *65a* in table 6.

Other components (5 percent):

Typic Cryofluvents, loamy, nearly level, are well drained soils developed in calcareous alluvium on levees of rivers, under a cover of cottonwood, white spruce, and shrubs. See *7a* in table 6.

Pergelic Cryofibrists, nearly level, are very poorly drained fibrous peat soils made up of extremely acid layered sphagnum moss and sedge peat. They occur in depressions under a dense cover of shrubs, forbs, and moss. See *28* in table 6.

HY1—Sphagnic Borofibrists, nearly level association is in the following major land resource area:

	Acres
170 Cook Inlet-Susitna Lowland	214,000

This association occupies large, nearly level muskegs of glaciated lowlands in south central Alaska. It includes many small ponds and a few low forested knolls and ridges. Elevations range from about 50 to 400 feet (15 to 120 m) above sea level. The vegetation on muskegs is dominantly mosses, sedges, and low shrubs. Forests of black spruce are in fringe areas. Paper birch and white spruce are dominant on the scattered knolls and ridges. The muskegs consist mainly of deep, fibrous peat, derived chiefly from sphagnum moss, in the surface layer and both moss and sedges in deeper layers. The water table is almost always near the surface. The dominant soils have severe limitations for almost all kinds of intensive use or development. They are primarily valuable for water storage and wildlife habitat.

Principal components:

Sphagnic Borofibrists, nearly level, (85 percent) consist of deep, poorly drained peat that has accumulated in broad depressions and basins in glaciated lowlands. The vegetation is mainly sedges, mosses, low shrubs, and clumps of black spruce. The peat freezes in winter and thaws slowly during the spring and early in summer. Beneath a surface mat of live sphagnum moss and roots, it consists chiefly of dark brown sphagnum moss fibers interbedded with layers of sedge fibers. This organic material is at least 5 feet (150 cm) thick over very gravelly drift. The lower layers of peat are usually more finely divided and contain a higher proportion of soft fibers. See *25* in table 6.

Typic Cryorthods, loamy, nearly level to rolling, (10 percent) are well drained soils on low, scattered knolls and ridges commonly surrounded by very poorly drained peat. The vegetation is a forest of paper birch and spruce. The soils formed in 24 to 40 inches (60 to 100 cm) of silty loess and ash over very gravelly drift. They have a thin albic horizon and a dark reddish brown to brown spodic horizon about 12 to 18 inches (30 to 45 cm) thick. See *120* in table 6.

Other components (5 percent):

Histic Cryaquepts, loamy, nearly level, are poorly drained soils in areas bordering muskegs. Vegetation is willow, alder, and black spruce. See *62* in table 6.

Sideric Cryaquods, loamy, nearly level to rolling, are somewhat poorly to poorly drained soils at the edges of knolls. The vegetation is commonly black spruce forest. See *111* in table 6.

HY2—Fluvaquentic Cryofibrists, nearly level association is in the following major land resource areas:

	Acres
171 Alaska Peninsula and Southwestern Islands	298,000
178 Western Alaska Coastal Plains and Deltas	968,000
Total	1,266,000

This association occupies large parts of coastal plains bordering Bristol Bay and the Bering Sea on the Alaska Peninsula (fig. 9).

Many rivers traverse the areas, and there are many large and small lakes. Some areas include low dunes made up of volcanic ash and cinders from active volcanoes in the nearby Aleutian Range. Narrow terraces border the major streams. Tidal marshes and black sandy beaches occur along the coasts.

The vegetation is dominantly water-tolerant species, including willows, horsetail, mosses, sedges, and grasses. Well drained soils on dunes and terraces support a dense cover of shrubs, forbs, and grasses. Some fairly stable beach ridges are covered with tall grass. Soils of this association are generally not suitable for cultivated crops or forests. Only small areas of the well drained soils can be used as construction sites. Most of this association provides excellent wildlife habitat, especially for migratory birds and caribou.

Principal components:

Fluvaquentic Cryofibrists, nearly level, (85 percent) are deep, very poorly drained organic soils on broad coastal plains. They consist of layers of fibrous peat derived dominantly from sedges and sphagnum moss. Several layers of volcanic ash occur within the soil profile. The vegetation on these soils includes willows, horsetail, sedges, and sphagnum moss. The soils are under a cool maritime climate and are seldom frozen.

Typically, these soils have a thin mat of mosses and sedges on the surface. Below the mat, to a depth of 50 inches (125 cm) to many feet, are layers of dark brown sedge peat and moss peat and thin layers of sandy volcanic ash. The water table is at or near the surface. These soils are generally extremely acid. See *27* in table 6.

Typic Cryandepts, loamy, nearly level to rolling, (10 percent) are well drained soils on low rolling dunes and stream terraces. They formed in layers of volcanic ash and cinders. The vegetation includes willows, crowberry, other low shrubs, feathermosses, and lichens.

Typically, these soils have upper layers of olive gray to very dark grayish brown sandy loam or loam about 16 to 30 inches (40 to 75 cm) thick over a substratum of dark olive gray cinder. Thin thixotropic layers are in the upper part of the soil. See *44* in table 6.

Other components (5 percent):

Terric Cryofibrists, nearly level, are similar to the Fluvaquentic Cryofibrists, but are less than 50 inches (125 cm) thick over a mineral substratum. See *29* in table 6.

Typic Cryaquents, clayey, nearly level, include fully vegetated coastal areas that are periodically inundated by tides. See *1* in table 6.

HY3—Fluvaquentic Cryofibrists, nearly level-Typic Cryandepts, very gravelly, nearly level to rolling association is in the following major land resource areas:

	Acres
171 Alaska Peninsula and Southwestern Islands	79,000
178 Western Alaska Coastal Plains and Deltas	124,000
Total	203,000

This association is on parts of large coastal plains interspersed with low rolling dunes and hills on the Bering Sea side of the Alaska Peninsula. Ash deposits from active volcanoes in the Aleutian Range are common. The area has a cool maritime climate, and soils are seldom frozen.

Figure 9.—**Marshy Fluvaquentic Cryofibrists occupy parts of coastal plains, especially near the mouths of major rivers. Ugashik Bay, Alaska Peninsula.**

The dominant soils are made up of very poorly drained fibrous moss and sedge peat. Well drained soils occur on dunes and low hills. They developed in ash underlain by cinders or very gravelly glacial deposits. The vegetation on the organic soils includes willows, horsetail, sphagnum moss, and sedges. Many areas have organic hummocks as high as 18 inches (45 cm). The dunes and hills support a stand of low shrubs and forbs, grasses, and lichens.

Organic soils of this association are not suited to most intensive uses but provide wildlife habitat for migrating waterfowl and caribou. The well drained soils are not well suited to cultivation or forestry but have few limitations for engineering purposes.

Principal components:

Fluvaquentic Cryofibrists, nearly level, (60 percent) are deep, very poorly drained, nearly level organic soils in broad depressions of coastal plains. They consist of fibrous peat from both sphagnum moss and sedges. The living vegetation on these soils includes willows, horsetail, sphagnum moss, and sedges.

Typically, these soils have a thin mat of live mosses and sedges on the surface. Below the mat to a depth of 60 inches (150 cm) to many feet are layers of sphagnum moss peat that alternate with layers of dark brown sedge peat and thin layers of volcanic ash. The water table is always at or near the surface. The soils are usually extremely acid. See *27* in table 6.

Typic Cryandepts, loamy, nearly level, (40 percent) are well drained soils on low rolling dunes and hills surrounded by broad muskegs on coastal plains. The soils formed in layers of silty and sandy volcanic ash over cinders or very gravelly glacial till. The vegetation includes willows, crowberry, other low shrubs, feathermosses, and lichens.

Typically, these soils have upper layers of olive gray to very dark grayish brown sandy loam or loam about 16 to 30 inches (40 to 75 cm) thick over a dark olive gray cindery or gravelly substratum. Some thixo-

tropic layers are in the upper part of the soil. See *44* in table 6.

HY4—Pergelic Cryofibrists, nearly level association is in the following major land resource areas:

	Acres
172 Copper River Plateau	25,000
174 Interior Alaska Lowlands	69,000
175 Kuskokwim Highlands	102,000
177 Norton Sound Highlands	65,000
178 Western Alaska Coastal Plains and Deltas	65,000
Total	326,000

This association occupies broad, nearly level, wet lowlands near large lakes, and coastal areas in western and interior Alaska. Elevations range from slightly above sea level near the coast to almost 1,000 feet (300 m) in interior regions. Although the areas are nearly level, some parts have a hummocky microrelief formed by closely spaced peat mounds that are about 2 to 4 feet (60 to 120 cm) high at the crest. Perennially frozen organic soils are dominant, but tracts of poorly drained silty and sandy soils with shallow permafrost tables are included. The vegetation is mainly sedges, mosses, low shrubs, and other water-tolerant plants that commonly grow on muskegs. A few areas support slow-growing black spruce.

Soils of the association have very severe limitations for any intensive use or development. They are not suitable for cultivation or forestry. Some of the native vegetation may be suitable for reindeer grazing, but the association is primarily valuable for natural water storage and wildlife habitat.

Principal components:

Pergelic Cryofibrists, nearly level, (80 percent) are very poorly drained perennially frozen peat soils on broad, nearly level muskegs. In summer, water is perched above the permafrost table and the thawed material is wet, soft, and spongy. The principal plants are sedges, mosses, and low shrubs. The peat generally consists of dark brown coarse sedge and moss fibers that are perennially frozen below a depth of 10 to 30 inches (25 to 75 cm). See *28* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level, (15 percent) occupy areas bordering muskegs. The dominant vegetation is sedge tussocks, mosses, low shrubs, and scattered black spruce. The soils are very poorly drained and are shallow over permafrost. They have a thick peaty surface mat over mottled dark gray silt loam that is perennially frozen below a depth of 10 to 20 inches (25 to 50 cm). The frozen material commonly contains thick lenses of clear ice. See *65a* and *65b* in table 6.

Other components (5 percent):

Typic Cryofluvents, loamy, nearly level, are well drained stratified silty and sandy soils on natural levees and low terraces near streams. See *7a, 7b,* and *7c* in table 6.

Pergelic Cryaquepts, loamy, nearly level, are very poorly drained soils with permafrost. They occupy low areas on flood plains. See *72a* and *72b* in table 6.

HY5—Pergelic Cryofibrists, nearly level-Histic Pergelic Cryaquepts, sandy, nearly level to rolling association is in the following major land resource area:

	Acres
178 Western Alaska Coastal Plains and Deltas	286,000

This association occupies broad low plains west of Iliamna Lake. Nearly level, poorly drained muskegs and low terraces partially covered by undulating stabilized dunes are dominant features of the landscape. Elevations are less than 200 feet (60 m) above sea level.

In the muskegs most of the soils consist of very poorly drained coarse fibrous peat underlain by permafrost. They are usually wet throughout the summer and support vegetation dominated by mosses and sedges. Most of the soils on low terraces are poorly drained. They formed in sandy volcanic ash and alluvium. The permafrost table is less than 30 inches below the surface. The vegetation consists mainly of sedges, mosses, and low shrubs. On scattered stabilized dunes, the soils formed in sandy volcanic ash and are free of permafrost. The vegetation is shrubs and stunted aspen and paper birch.

Soils of the association are not potentially suitable for cultivation or forestry. Except for the soils on stabilized dunes, they have severe limitations for most uses other than wildlife habitat. The soils of the dunes, where they cover a sufficiently large area, are suitable for roads and structures.

Principal components:

Pergelic Cryofibrists, nearly level, (55 percent) occur in muskegs and consist of very poorly drained coarse fibrous peat underlain by permafrost. The vegetation is dominantly mosses and sedges. Beneath a thick mat of vegetation, the peat consists mainly of coarse, dark brown, slightly decomposed moss and sedge fibers. The soils are extremely acid. The permafrost table is commonly less than 30 inches (75 cm) below the surface. See *28* in table 6.

Histic Pergelic Cryaquepts, sandy, nearly level to rolling, (35 percent) are poorly drained soils with permafrost on nearly level low terraces. The vegetation is dominated by sedge tussocks, mosses, and shrubs. Beneath a thick peaty surface layer, the soils consist of mottled gray loamy fine sand that, in places, contains a few thin strata of silty material. The permafrost table is commonly less than 30 inches (75 cm) below the surface. See *67* in table 6.

Typic Cryandepts, sandy, nearly level to rolling, (10 percent) are excessively drained soils without permafrost that have developed in sandy volcanic ash on low stabilized dunes. The dominant vegetation is shrubs, grasses, forbs, and scattered aspen. Beneath a thin surface layer of partially decomposed organic material, the soils have very dark brown sandy loam upper layers grading with depth to yellowish brown or olive brown sand. See *46* in table 6.

IA1—Typic Cryandepts, loamy, hilly to steep association is in the following major land resource area:

	Acres
171 Alaska Peninsula and Southwestern Islands	1,026,000

This association occupies hilly plateaus, valleys, and foot slopes near volcanic mountains on the Alaska Peninsula and Aleutian Islands. Except on a few included high peaks, elevations are less than 2,000 feet (600 m) above sea level. Most of the soils formed in thick deposits of volcanic ash and support a vegetative

cover dominated either by low shrubs or by grasses, alder, and associated shrubs and forbs.

Largely because of climatic limitations and steep slopes, soils of the association are not suitable for cultivation. On many soils, however, the native vegetation is potentially suitable for grazing by either cattle and sheep or reindeer.

Principal components:

Typic Cryandepts, loamy, hilly to steep, (65 percent) are well drained soils on hills and foot slopes near volcanic mountains. The vegetation is either a complex of grasses, alder, and associated shrubs and forbs, or a mat of low shrubs. The grasses tend to occupy hills at lower elevations; the low shrubs occur at higher elevations and on lower ridgetops exposed to cold winds. Typically, the soils have dark reddish brown or black upper layers grading with depth to yellowish brown or grayish brown. Many of the soils, however, show color stratification. All formed in stratified sandy, silty, and cindery volcanic ash. See *45* in table 6.

Dystric Cryandepts, loamy, hilly to steep, (15 percent) are well drained soils on low hills farthest from active volcanoes. The vegetation is dominantly either grass, alder, and associated forbs and shrubs or low shrubs. Beneath a mat of partially decomposed organic material, the black to dark reddish brown silt loam upper layers grade to yellowish brown with depth. The soils formed in thick deposits of silty volcanic ash. See *51b* in table 6.

Rough mountainous land (10 percent) consists of areas of bare rock and stony rubble on volcanic cones, peaks, and high ridgetops. There is little or no vegetation. See *145* in table 6.

Other components (10 percent):

Fluvaquentic Cryofibrists, nearly level, are very poorly drained fibrous organic soils interbedded with layers of volcanic ash. They occur in depressions and on valley bottoms. The vegetation is sedges, mosses, and low shrubs. See *27* in table 6.

Typic Cryandepts, sandy, hilly to steep, are well drained soils made up principally of sandy volcanic ash. They occur on steep sides of narrow valleys. The vegetation is grasses and associated forbs and shrubs. See *47* in table 6.

Cinder land consists of unvegetated areas of cindery volcanic ash on the slopes of volcanic cones. See *140* in table 6.

IA2—Typic Cryandepts, loamy, hilly to steep-Rough mountainous land association is in the following major land resource area:

	Acres
171 Alaska Peninsula and Southwestern Islands	1,769,000

This association occurs on hilly to mountainous parts of the Aleutian Islands, the Shumagin Islands, and the Alaska Peninsula. Except for the organic soils, the association formed in a blanket of volcanic ash or cinders over basaltic bedrock. Most slopes are steep, and many are deeply dissected by streams flowing from higher mountains. Some gentle and moderate foot slopes are included. Steep sea cliffs, some of them consisting of vertical exposures of basalt, are common on island rims.

There are two principal types of vegetation. One is dominated by grasses, fireweed, ferns, and a variety of other herbaceous plants and shrubs. Alder patches are common and are dominant in many areas of the Shumagin Islands and the Alaska Peninsula. They are less extensive on the Aleutian Islands. The other major vegetation type is low shrubs, sedges, and mosses. It occurs primarily in areas exposed to strong cold winds, such as ridgetops, high slopes of mountains, and low rolling plains.

Most soils are stratified with fine thixotropic, sandy, and cindery volcanic deposits. The ash in most places is many feet thick, but some steeper slopes have only thin ash layers over fragmented basaltic rock. In general, the coarser volcanic material is close to active volcanoes and the finer material is more distant. Nearly all of the ashy soils are black or brown and are high in organic matter. Organic soils occupy depressions, some broad valley bottoms, and some high ridges.

Most areas in which grasses, fireweed, and associated plants are dominant can be used as rangeland for cattle or sheep. These and areas dominated by shrubs are suitable as reindeer range.

The cool climate of the region limits crops other than grass to a few hardy vegetables. Limitations for roads, buildings, and other construction are severe in most soils because of steep slopes or wetness. Well drained soils on gentle slopes have few limitations. Many areas are of great importance as nesting sites for migratory birds.

Principal components:

Typic Cryandepts, loamy, hilly to steep, (45 percent) are well drained soils on most low hills and foot slopes. Most areas are strongly dissected and have many short steep slopes. Some foot slopes are fairly smooth except for widely separated, deeply incised drainage channels. The ash in which the soils developed rests in places directly on bedrock and in other places on glacial till. The soils have a mat of organic material 3 to 15 inches (8 to 40 cm) thick. Below this mat is stratified fine thixotropic, loamy, sandy, and cindery ash, each layer representing a separate volcanic deposit. Colors are normally black or dark reddish brown at the surface and dark brown at greater depth. Buried former surface layers are common. The proportion of organic matter is high, especially in existing and buried surface layers.

Typic Cryandepts support both grass-alder and shrubby tundra vegetation. As a rule, the low shrubs are dominant in areas that are exposed to frequent high winds. See *45* in table 6.

Rough mountainous land (20 percent) in this association consists principally of the upper parts of relatively small volcanic cones. The cones have little or no vegetation and are made up largely of volcanic cinders and hardened lava. Some cinder flows extend to lower slopes. See *145* in table 6.

Typic Cryandepts, very gravelly, hilly to steep, (15 percent) occur principally in higher positions or in areas close to volcanoes. They consist mostly of sandy volcanic ash, but commonly contain layers of fine thixotropic ash and cinders. Colors range from very dark brown or dark reddish brown at the surface to dark

brown with increasing depth. Buried surface layers are fairly common. Vegetation is dominated by low shrubs, but patches of grass and alder also occur. See *49a* in table 6.

Dystric Cryandepts, loamy, hilly to steep, (10 percent) occur on slopes at low elevations, farther from active volcanoes than the Typic Cryandepts. They consist principally of fine thixotropic volcanic ash and layers of sandy or cindery ash. The surface layer and buried former surface layers in these soils generally are black and are higher in organic matter than the loamy Typic Cryandepts, but in other respects the soils are similar. They support both grass-alder and low shrubby vegetation. In areas covered by low shrubs the soil surface is irregular, and there are many mounds as high as 3 feet (90 cm). See *51b* in table 6.

Fluvaquentic Cryofibrists, nearly level, (5 percent) are very poorly drained organic soils in depressions and on broad valley bottoms. They are made up principally of fibrous sedge peat that extends to depths greater than 5 feet (150 cm). Lenses of volcanic ash are common. See *27* in table 6.

Other components (5 percent):

Andic Cryaquepts, loamy, nearly level, are poorly drained soils on flood plains of major streams. They formed in ashy material washed from adjacent slopes. The vegetation is principally grasses, alder, and willows. See *61* in table 6.

Typic Cryopsamments, sandy, hilly to steep, are excessively drained soils on coastal dunes. They support adapted grasses and other plants. Soil blowing and deposition of sand on adjoining areas will occur if the dunes are disturbed. See *22* in table 6.

Lithic Cryofolists, hilly to steep, are well drained soils on high ridges that consist of a thin layer of plant litter that rests directly on basaltic bedrock. The vegetation is dominated by low shrubs and short grasses. See *33* in table 6.

IA3—Typic Cryandepts, sandy, nearly level to rolling association is in the following major land resource areas:

	Acres
171 Alaska Peninsula and Southwestern Islands	272,000
178 Western Alaska Coastal Plains and Deltas	696,000
Total	968,000

This association occurs in areas bordering Bristol Bay on the Alaska Peninsula. Elevations range from close to sea level near the coast to about 1,000 feet (300 m) on the foot slopes of the Aleutian Range. Many small lakes and muskegs occur in areas of rolling topography. The nearly level areas and gentle slopes have only a few muskegs in depressions. The dominant vegetation is low shrubs and forbs, sedges, and lichens.

Because of the cool climate in which this association occurs, only grasses and some hardy vegetables can be grown successfully. Commerical tree species are not part of the native vegetation, which is well adapted to reindeer grazing. There are few limitations for most kinds of construction.

Principal components:

Typic Cryandepts, sandy, nearly level to rolling, (90 percent) are deep, well drained, sandy soils developed in deposits of volcanic ash. The vegetation is dominantly low shrubs, forbs, and lichens. Typically, the soils consist of layered sandy and cindery volcanic ash that is normally strongly to very strongly acid. See *46* in table 6.

Fluvaquentic Cryofibrists, nearly level, (10 percent) are very poorly drained fibrous organic soils in depressions on coastal plains. The dominant vegetation is sedges, mosses, and low willows. Typically, the soils are made up of dark brown fibrous sedge peat containing seams and patches of volcanic ash. The peat is more than 50 inches (125 cm) thick. See *27* in table 6.

IA4—Typic Cryandepts-Histic Pergelic Cryaquepts, sandy, nearly level to rolling association is in the following major land resource areas:

171 Alaska Peninsula and Southwestern Islands	460,000
178 Western Alaska Coastal Plains and Deltas	1,004,000
Total	1,464,000

This association occupies broad outwash plains with stabilized dunes and many small ponds and streams in areas near the head of Bristol Bay (fig. 10). Elevations range from about sea level near the coast to about 1,000 feet (300 m) near the Aleutian Range. The dominant vegetation is low shrubs, willow, grasses, mosses, and lichens. A few stands of white and black spruce occur. Permafrost is confined to the poorly drained soils in lower parts of the landscape.

The well drained soils of the association can be used for grasses and some hardy vegetables, but more intensive agriculture probably is not feasible. No commercial forestry is possible. The native vegetation is suitable for reindeer grazing. The well drained soils are well suited to construction and other engineering uses, but the poorly drained soils have severe limitations for these purposes.

Principal components:

Typic Cryandepts, sandy, nearly level to rolling, (45 percent) are well drained soils that consist of sandy volcanic ash. They occur on low ridges, knolls, and stabilized dunes on broad terraces. Elevations range from about sea level to about 1,000 feet (300 m). The vegetation is dominantly low shrubs, mosses, and lichens. The soils support a forest of white spruce in areas bordering the upper Alagnak River.

Typically, under a thin surface mat of organic matter with ash lenses, the soils consist of dark reddish brown, dark brown, and dark grayish brown layers of sandy volcanic ash. See *46* in table 6.

Histic Pergelic Cryaquepts, sandy, nearly level to rolling, (40 percent) are poorly drained soils with permafrost in broad drainageways, in slight depressions, and on long smooth slopes. The vegetation is dominantly low shrubs, sedges, mosses, and lichens.

Typically, these soils have a thick peaty surface mat over dark mottled volcanic ash with a gray substratum. The permafrost table is 10 to 20 inches (25 to 50 cm) deep. See *67* in table 6.

Fluvaquentic Cryofibrists, nearly level, (15 percent) are poorly drained fibrous organic soils in depressions in the outwash plains. The vegetation is dominantly

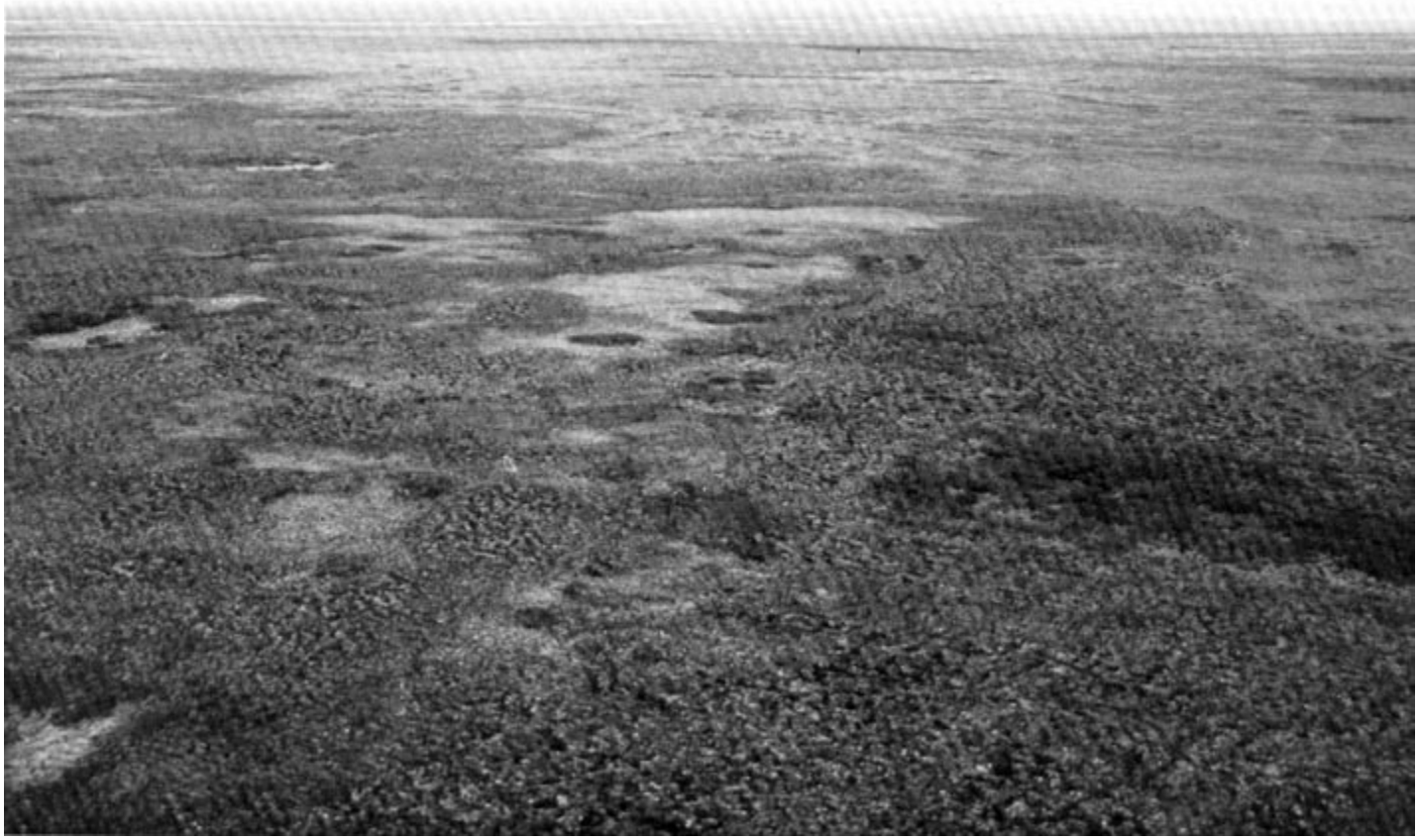

Figure 10.—Sandy Typic Cryandepts occur on low dunes and sandy Histic Pergelic Cryaquepts are in depressions between dunes. North of Becharof Lake.

sedges, mosses, and low shrubs. The soils consist of deep fibrous sedge peat with seams and patches of sandy volcanic ash. See *27* in table 6.

IA5—Typic Cryandepts, sandy, hilly to steep association is in the following major land resource area:

	Acres
171 Alaska Peninsula and Southwestern Islands	265,000

This association occurs in the vicinity of Mt. Veniaminof. It occupies long mountain foot slopes dissected by many streams and drainageways and mantled with thick deposits of volcanic ash and cinders. A few muskegs are in depressions in the rolling foot slopes. Elevations range from sea level to about 2,500 feet (760 m).

In areas draining to the Pacific Ocean, the vegetation up to elevations of about 750 feet (230 m) is principally grasses, alder, and willow. Above 750 feet it is tundra consisting of low shrubs and forbs, mosses, and lichens. On the Bering Sea side of the mountain, the vegetation includes crowberry and other shrubs, forbs, and short grasses.

These soils are generally too cold and steep for cultivation. No forests are in this region. Many areas are suitable for grazing, particularly by reindeer. Steep slopes limit the use of most of the area as construction sites.

Principal components:

Typic Cryandepts, sandy, hilly to steep, (95 percent) are well drained to excessively drained ashy soils mostly on long foot slopes of mountains. Many deep ravines are cut into the slopes. The vegetation is dominantly grasses, alder, and willow at lower elevations on slopes draining to the Pacific and shrubby vegetation elsewhere. Typically, the soils have a layer of very dark brown loamy volcanic ash over layered very dark grayish brown sandy and cindery ash. See *47* in table 6.

Fluvaquentic Cryofibrists, nearly level, (5 percent) are deep, very poorly drained, fibrous organic soils in depressions on mountain foot slopes. The vegetation includes sedges, willows and other shrubs, and mosses. Typically, the soils consist of very dark grayish

brown fibrous sedge peat. Thin layers of volcanic ash are common in the upper 5 feet (150 cm). See *27* in table 6.

IA6—Typic Cryandepts, very gravelly, nearly level to rolling association is in the following major land resource areas:

	Acres
171 Alaska Peninsula and Southwestern Islands	435,000
178 Western Alaska Coastal Plains and Deltas	207,000
Total	642,000

This association occupies foot slopes of volcanoes and coastal plains on the Alaska Peninsula (fig. 11). The soils formed in thick deposits of volcanic ash and cinder over glacial till or outwash. Vegetation includes low willows, crowberry, other low shrubs and forbs, grasses, and lichens. Depressions in the coastal plains contain organic soils under sedges, mosses, horsetail, and willows. These areas have no permafrost, but polygonal patterns and low hummocks occur in places.

The cool climate of the area limits potential crops to grasses and some hardy vegetables. The natural vegetation is suitable for reindeer grazing. Wildlife species include caribou, brown bear, and moose. Most areas are suitable for roads, buildings, and other construction purposes. The organic soils have very severe limitations for these uses.

Principal components:

Typic Cryandepts, very gravelly, nearly level to rolling, (85 percent) are well drained to excessively drained soils formed in layered volcanic ash and

Figure 11.—Cindery Typic Cryandepts occupy rolling plains under low shrubby vegetation. Fluvaquentic Cryofibrists are in shallow depressions, commonly in association with lakes and ponds. Near Mother Goose Lake.

cinders over glacial deposits. The vegetation includes low willows, crowberry, other shrubs and forbs, grasses, and lichens.

Typically, these soils have a thin surface layer of olive gray volcanic ash over a very dark grayish brown loamy layer to a depth of 16 to 30 inches (40 to 75 cm). This is underlain by dark olive gray cindery volcanic material and, at still greater depths, very gravelly glacial drift. The upper part of the soil commonly contains one or more layers of thixotropic fine ash. See *48a* in table 6.

Fluvaquentic Cryofibrists, nearly level, (15 percent) are very poorly drained fibrous organic soils in depressions in the coastal plains. They consist of layered sphagnum moss and sedge peat to depths of more than 5 feet (150 cm). The vegetation includes low willows, sphagnum moss, and sedges. These soils are extremely acid and contain thin layers of sandy volcanic ash. See *27* in table 6.

IA7—Typic Cryandepts, very gravelly, nearly level to rolling-Pergelic Cryofibrists, nearly level association is in the following major land resource areas:

	Acres
171 Alaska Peninsula and Southwestern Islands	381,000
175 Kuskokwim Highlands	83,000
178 Western Alaska Coastal Plains and Deltas	326,000
Total	790,000

This association occupies parts of rolling plains bordering Illiamna Lake and Nuyakuk Lake north of Dillingham. These areas consist dominantly of rolling ground moraines, but the landscape also includes inactive and active stream channels, uplifted beaches, hilly terminal moraines, glacial outwash plains, and many small lakes and muskegs. Elevations range from 200 feet to about 1,000 feet (60 to 300 m) above sea level. The glacial material is very gravelly and is covered with volcanic ash. In a few small hilly areas the ash is underlain by bedrock at shallow depths. The muskegs consist of coarse acid moss and sedge peat, with permafrost at shallow depth.

The vegetation near Nuyakuk is dominantly a white spruce forest. Near Lake Illiamna, it consists of low willows, crowberry, other shrubs, grasses, and lichens. Sphagnum moss and sedges grow in the muskegs.

This association provides habitat for wildlife, including caribou, bear, moose, and many nesting birds. Potential crops are limited to grasses and some hardy vegetables. The dominant soils are suitable for roads, buildings, and other construction, but the soils with permafrost have severe limitations for these purposes.

Principal components:

Typic Cryandepts, very gravelly, nearly level to rolling, (60 percent) are well drained acid soils developed in shallow volcanic ash over very gravelly glacial material. They occur on ground moraines, terminal moraines, outwash plains, and old beach ridges. The vegetation is dominantly low tundra species, but in the vicinity of Nuyakuk Lake, below elevations of about 800 feet (250 m), it is a white spruce forest. A few areas of sparse white spruce and paper birch occur in the Illiamna Lake area.

Typically, the soils have less than 20 inches (50 cm) of black and dark reddish brown fine thixotropic volcanic ash over brown very gravelly glacial till. In places, frost action has mixed the till and the ash near the surface. See *48a* and *48b* in table 6.

Pergelic Cryofibrists, nearly level, (25 percent) are deep, very poorly drained organic soils in depressions and on valley bottoms. They consist of fibrous sedges and mosses. Thin lenses of volcanic ash are common. Permafrost is usually at shallow depths. The water table is always at or near the surface. See *28* in table 6.

Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling, (10 percent) are poorly drained soils on low knolls and ridges on ground moraines and outwash plains. They formed in sandy and gravelly alluvium or glacial till mixed with volcanic ash and support a vegetative cover that includes sedge tussocks and mosses.

Typically, the soils have a thick mat of fibrous peat over dark grayish brown and gray mottled sand, very gravelly sand, or sandy volcanic ash. The water table is usually at the mineral surface. Permafrost is at a shallow depth. See *68* in table 6.

Lithic Cryandepts, very gravelly, hilly to steep, (5 percent) cover low hills with steep side slopes at elevations of 200 to 800 feet (60 to 250 m). The vegetation includes white spruce, paper birch, low shrubs, and lichens.

Typically, the soils have a thin mat of partly decomposed litter, a thin dark layer of fine thixotropic volcanic ash, and brown very stony loam which consists of ash mixed with rock fragments. The depth to consolidated bedrock (basalt) is less than 20 inches (50 cm). These soils are normally strongly acid. Spots of bedrock outcrop are common. See *54* in table 6.

IA8—Typic Cryandepts-Pergelic Cryaquepts, very gravelly, nearly level to rolling association is in the following major land resource area:

	Acres
175 Kuskokwim Highlands	1,001,000

This association occupies glaciated terrain, including high rounded hills, rolling moraines, terraces, outwash plains, and muskegs in southwestern Alaska. A shallow deposit of silty volcanic ash mantles the entire area. Elevations range from close to sea level to about 1,400 feet (430 m). The vegetation is dominantly tundra consisting principally of low shrubs. Alder and grasses grow on the upper slopes of some hills. Moraines and terraces at lower elevations have a cover that includes willow, low shrubs, and, in places, white spruce and paper birch. Long foot slopes and broad depressions have a thick cover of tall willows, sedge tussocks, and moss. They are underlain by permafrost.

Soils of this association are generally too gravelly for cultivation. Except in small areas, trees are not a component of the native vegetation. The vegetation provides habitat for a variety of wildlife species, especially caribou, and would be suitable for reindeer grazing. The well drained, nearly level to rolling soils on moraines are suitable sites for roads, buildings, and other structures. The poorly drained soils on long slopes and in depressions have severe limitations for these uses.

Principal components:

Typic Cryandepts, very gravelly, nearly level to rolling, (45 percent) occupy higher parts of rolling moraines and terraces. They support, for the most part, vegetation dominated by low shrubs and lichens. Areas of alder and grass occur on higher moraines, and patches of white spruce and paper birch are on low moraines and terraces. The soils consist of a thin layer of silty ash over mixed volcanic ash and very gravelly glacial drift or outwash.

Typically, the soils have a thin dark reddish brown upper layer of fine thixotropic volcanic ash and a lower layer of yellowish brown silty ash over mixed gravelly glacial drift and volcanic ash. Very gravelly glacial drift is at a depth of about 16 inches (40 cm). These soils are strongly acid. In some places unvegetated frost scars and gravelly knolls are prominent. See *48b* in table 6.

Pergelic Cryaquepts, very gravelly, nearly level to rolling, (30 percent) are poorly drained soils on long gentle slopes and in broad depressions in the moraines. They support a thick stand of sedges, low shrubs, and other tundra plants. The soils have a thin mat of well decomposed organic matter and a thin black layer of thixotropic volcanic ash over mottled gravelly and very gravelly silt loam made up of mixed ash and glacial drift. Permafrost occurs at a depth of less than 24 inches (60 cm). In places, the soils consist of shallow sandy loam over very gravelly sandy loam or sand. See *75* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (15 percent) are poorly drained soils on long gentle slopes and in broad depressions in glacial moraines and terraces. They support, for the most part, willows, low shrubs, sedge tussocks, and moss. The soils consist of a thick surface mat of coarse and fine organic matter over very dark gray silt loam underlain with mottled dark gray gravelly silt loam. Permafrost is normally at a depth of less than 24 inches (60 cm). See *65a* in table 6.

Pergelic Cryofibrists, nearly level, (10 percent) are very poorly drained organic soils in depressions in the terraces and on low moraines of valleys. They support a dense cover of sphagnum moss, cottongrass, and, in places, patches of dwarf birch. The soils have about 6 inches of living moss at the surface underlain by layers of fibrous moss peat and intervening layers of fibrous and partially decomposed sedge peat. Permafrost is commonly at a depth of less than 16 inches (40 cm). The peat is very strongly acid. See *28* in table 6.

IA9—Typic Cryandepts, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
170 Cook Inlet-Susitna Lowland	156,000
171 Alaska Peninsula and Southwestern Islands	2,578,000
173 Alaska Range	84,000
175 Kuskokwim Highlands	489,000
178 Western Alaska Coastal Plains and Deltas	29,000
179 Bering Sea Islands	62,000
Total	3,398,000

The association occupies low rounded mountains and moraine-covered mountain foot slopes and foothills of the Aleutian Range, (fig. 12), the southernmost part of the Alaska Range, and adjoining areas. Several high rocky peaks are included. The association also occurs on steep basaltic hills of the Pribilof Islands. Elevations range from sea level to about 3,000 feet (900 m). Most of the soils formed in thick volcanic ash and cinder deposited on moraines and glacially scoured bedrock. At higher elevations, however, the ash is thin over bedrock or gravelly glacial till.

The soils support two kinds of vegetation. In areas adjacent to the Pacific Ocean or Cook Inlet, they support principally alder, grasses, and other shrubs and forbs up to elevations of about 1,000 feet (300 m). At higher elevations and in areas exposed to winds from the Bering Sea the vegetation is dominantly crowberry, other low shrubs and forbs, and short grasses. Willow and grass grow in some sheltered drainageways and valleys.

Soils of this association are not suitable for agriculture or forestry but can be used for reindeer grazing. They provide habitat for a variety of wildlife species, including bear, moose, and caribou. Because of its steepness the area is of limited use for most kinds of construction.

Principal components:

Typic Cryandepts, very gravelly, hilly to steep, (80 percent) are well drained soils on dissected mountain foot slopes. They formed in layered volcanic material. The vegetation is either alder and grasses or low shrubs and associated plants, depending on elevation and location.

Typically, these soils have a thin surface mat of dark grayish brown partly decomposed plant litter mixed with volcanic ash. The upper part of the soils consists of very dark grayish brown sandy and loamy volcanic ash about 18 inches (45 cm) thick that normally contains one or more layers of fine thixotropic ash. This overlies dark yellowish brown cindery material that is generally more than 30 inches (75 cm) thick over glacial till or bedrock. The soils are strongly acid. See *49a* and *49b* in table 6.

Lithic Cryandepts, very gravelly, hilly to steep, (10 percent) are shallow, well drained ashy soils on ridges and upper slopes of low rounded mountains. Most occur at elevations greater than 1,000 feet (300 m). The vegetation is principally low shrubs and forbs.

Typically, the soils have a thin surface layer of very dark grayish brown loamy and cindery ash. Below this is dark yellowish brown mixed ash and weathered bedrock. Consolidated bedrock is at depths of less than 20 inches (50 cm). See *54* in table 6.

Rough mountainous land (10 percent) includes steep mountain peaks and ridges and talus slopes. These areas are barren or support only sparse alpine vegetation. See *145* in table 6.

IA10—Typic Cryandepts-Histic Pergelic Cryaquepts, very gravelly, hilly to steep association is in the following major land resource area:

	Acres
171 Alaska Peninsula and Southwestern Islands	334,000

This association occupies an area of high ridges and

Figure 12.—Typic Cryandepts occur on steep hills close to active volcanoes. The vegetation is dominantly low shrubs or grasses. Unvegetated rock outcrops are common. Near head of Becharof Lake.

intervening broad valleys in the upper Alaska Peninsula. Glacial deposits cover all but the highest parts of the ridges. The soils formed in overlying deposits of volcanic ash. Elevations range from 200 feet (60 m) in the valleys to about 2,000 feet (600 m) on the ridgetops. The vegetation is dominantly low shrubs, willow, and alder, but in places in the valleys there is a sparse cover of spindly white spruce. Valley bottoms and long foot slopes have a cover of sphagnum moss, sedge tussocks, and low shrubs and forbs.

No agriculture or commercial forestry is feasible in this area. Because of steepness on the hills and ridges and permafrost in lower areas, limitations are severe for most kinds of construction.

Principal components:

Typic Cryandepts, very gravelly, hilly to steep, (50 percent) are well drained soils on most hillsides. The vegetation includes willow, alder, low shrubs, and, in places, spindly white spruce. The soils generally have less than 20 inches (50 cm) of stratified loamy and sandy volcanic ash containing a few layers of fine thixotropic ash over very gravelly glacial till. They are very strongly acid. On included gentle to rolling slopes of glacial moraines the ash is moderately deep. See *49a* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (35 percent) are poorly drained soils in drainageways and on long foot slopes. They support a dense cover of sphagnum moss, sedge tussocks, and low shrubs. The soils have a thick mat of partially decomposed organic matter over mottled olive gray ash underlain by very gravelly loam or silt loam. Perma-

frost is normally less than 10 inches (25 cm) below the mineral surface. See *69* in table 6.

Lithic Cryandepts, very gravelly, hilly to steep, (10 percent) are shallow well drained soils on steep hills and high ridgetops. The vegetation is dominantly low shrubs, grasses, and lichens. Beneath a thin mat of partially decomposed organic material, the soils have a thin dark layer of stratified volcanic ash over very gravelly or flaggy loam. Consolidated bedrock is less than 20 inches (50 cm) deep. See *54* in table 6.

Fluvaquentic Cryofibrists, nearly level (5 percent) are deep very poorly drained organic soils in depressions in valley bottoms. The vegetative cover includes sedge tussocks, sphagnum moss, and other wet tundra species. The soils consist of layered sedge and moss peat and contain thin lenses of volcanic ash. They are extremely acid. See *27* in table 6.

IA11—Typic Cryandepts, very gravelly, hilly to steep-Rough mountainous land association is in the following major land resource area:

	Acres
171 Alaska Peninsula and Southwestern Islands	2,241,000

This association occupies steep mountainous areas in the eastern part of the Peninsula. These areas are dissected by many drainageways, streams, and braided rivers. Many are glacier fed. Elevations range from nearly sea level on the coast to about 5,500 feet (1,675 m) on the highest peak. The vegetation along the rivers is dominantly willow, alder, and grasses. On valley walls and in areas protected from strong winds below 1,000 feet (300 m), alder, grasses, and associated shrubs and forbs are dominant. Areas above 1,000 feet (300 m) and areas exposed to strong winds support low shrubs, forbs, and lichens. Mountain peaks and ridges, rock escarpments, and talus slopes have a sparse shrubby tundra vegetation or are barren.

Because of steep slopes and low summer temperatures, no agriculture or forestry is feasible in these areas. The slopes impose severe limitations on all kinds of construction.

Principal components:

Typic Cryandepts, very gravelly, hilly to steep, (55 percent) consist of shallow, well drained volcanic ash over very gravelly glacial till on valley sides and rounded hills. They range in elevation from sea level to about 2,000 feet (600 m). Below 1,000 feet (300 m) the vegetation is dominantly alder and grasses. Areas above 1,000 feet (300 m) or areas exposed to strong winds have a cover dominated by low shrubs, forbs, and lichens.

Typically, under a mat of litter and roots, the soils consist of 10 to 20 inches (25 to 50 cm) of dark reddish brown loamy volcanic ash over dark brown very gravelly loam. The soils are strongly acid. See *49a* in table 6.

Rough mountainous land (35 percent) consists of mountain peaks and ridges, rock escarpments, and talus slopes with little or no soil cover. These areas are generally above 2,000 feet (600 m) and are either barren or sparsely vegetated with shrubby tundra plants. See *145* in table 6.

Riverwash (10 percent) consists of recent deposits of sand and gravel on flood plains of braided rivers. These areas are mostly barren, but willow, alder, and grasses normally grow on the riverbanks. See *144* in table 6.

IA12—Dystric Cryandepts, loamy, nearly level to rolling-Fluvaquentic Cryofibrists, nearly level association is in the following major land resource area:

	Acres
171 Alaska Peninsula and Southwestern Islands	993,000

This association occupies nearly level coastal plains in the southwestern parts of the Alaska Peninsula and on southern Kodiak Island and other southwestern islands (fig. 13). Elevations range from sea level to about 100 feet (30 m). These are areas of gravelly alluvium, cinders, or weathered rock mantled by thick layers of loamy and sandy volcanic ash. Depressions are filled with sedge peat.

The vegetation in most areas is principally willow, crowberry, and other low shrubs and forbs. In some areas grass and alder are dominant. Sedges, mosses, and other water-tolerant species are the principal plants in the depressions.

Agriculture is limited to grasses and a few hardy vegetables. No forestry is feasible. The native vegetation is well suited to grazing by reindeer. There are few limitations to construction on the dominant well drained soils, but limitations are severe on the organic soils.

Principal components:

Dystric Cryandepts, loamy, nearly level to rolling, (70 percent) are well drained soils made up principally of fine thixotropic volcanic ash. The dominant vegetation is willow, crowberry, and other low shrubs and forbs. In areas sheltered from high winds, grass and alder are dominant.

Typically, these soils have black and dark reddish brown layers of volcanic ash that range from sand to fine thixotropic material. The thixotropic material is dominant. The substratum of gravelly waterlaid material, cinders, or weathered rock is deeper than 30 inches (75 cm). See *50a* in table 6.

Fluvaquentic Cryofibrists, nearly level, (30 percent) are very poorly drained fibrous peat soils that have the water table always at the surface. They occupy depressions in the coastal plains. The dominant vegetation is sedges, low willows, and mosses.

Typically, the soils consist of dark brown fibrous sedge peat more than 60 inches (150 cm) thick over a mineral substratum. Seams and patches of ash are common. See *27* in table 6.

IA13—Dystric Cryandepts-Histic Pergelic Cryaquepts, loamy, nearly level to rolling association is in the following major land resource area:

	Acres
175 Kuskokwim Highlands	1,649,000

This association occupies low moraine hills, terraces, and glacial outwash plains north of Bristol Bay. The terrain is irregular, characterized by many knolls, low hills, and depressions and many streams, drainageways, and lakes. Elevation ranges from about 200 feet to 600 feet (60 to 180 m) in most areas, but a few higher peaks are included. The soil material is dominantly volcanic ash underlain by gravelly glacial till,

Figure 13.—Dystric Cryandepts with very hummocky surface occupy slightly elevated parts of plain under crowberry, alder, and other low shrubs. Fluvaquentic Cryofibrists formed from sedges occupy lower parts of the plain. Tugidak Island.

outwash deposits, or silty alluvium. Organic soils occupy many depressions.

Higher parts of outwash plains, terraces, and moraines are covered dominantly by low alder and other shrubs. Patches of aspen, white spruce, paper birch, and willows occupy some knolls and terraces near the Nushagak River. Lower gentle slopes of moraines and terraces have a low hummocky growth of sedges, willows, other shrubs, and mosses. They are usually wet. Willow, alder, and cottonwood occupy well drained parts of flood plains. Mosses and sedges are dominant in nearly level depressions.

Most of the well drained soils are suitable for cultivation, and some can be used for commercial forestry. Soils of the area provide habitat for a variety of wildlife species, including caribou and migratory waterfowl.

Moraine hills and gravelly terraces with well drained soils are the most feasible sites for roads, buildings, and other structures. Poorly drained soils on gentle slopes and in depressions have severe limitations for most uses.

Principal components:

Dystric Cryandepts, loamy, nearly level to rolling, (50 percent) are well drained soils on upper slopes of moraine hills and terraces. They formed in moderately deep volcanic ash underlain by gravelly drift. The vegetation is dominantly alder and low shrubs.

Typically, these soils have a thin black mat of organic litter, a dark brown layer of fine thixotropic ash about 32 inches (80 cm) thick, and a substratum of dark yellowish brown and olive brown gravelly

sandy loam. They are strongly acid. See *50b* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (30 percent) are poorly drained soils on lower hillsides and some long gentle slopes on terraces and outwash plains. The dominant vegetation includes sedges, mosses, willows, and other shrubs.

Typically, these soils have a thick surface layer of partially decomposed sedge and moss peat 8 to 16 inches (20 to 40 cm) thick over silty loam that is permanently frozen at shallow depth. One or more thin layers of volcanic ash commonly occur in the organic mat. Both the organic material and the underlying silty material are strongly acid. Very gravelly glacial till or outwash is normally less than 3 feet (90 cm) deep. See *65a* in table 6.

Pergelic Cryofibrists, nearly level, (15 percent) are very poorly drained organic soils in depressions in hilly moraines or outwash plains. The vegetation is dominated by sedges and mosses. The soils consist mostly of slightly decomposed sedge peat more than 60 inches (150 cm) thick. Normally one or more thin layers of volcanic ash occur in the peat. The organic material is strongly acid. See *28* in table 6.

Typic Cryofluvents, loamy, nearly level, (5 percent) are well drained soils on natural levees bordering streams. They receive fresh deposits of alluvium from repeated flooding. The vegetation is dominantly cottonwood, willow, and alder. Typically, these soils consist of stratified dark grayish brown and olive gray silt loam and sand over a substratum of very gravelly sand. See *7a* in table 6.

IA14—Dystric Cryandepts, loamy, hilly to steep association is in the following major land resource areas:

	Acres
170 Cook Inlet-Susitna Lowland	47,000
171 Alaska Peninsula and Southwestern Islands	1,471,000
175 Kuskokwim Highlands	76,000
Total	1,594,000

This association mostly occupies steep hills and foot slopes on Kodiak Island (fig. 14), the Alaska Peninsula, and adjacent islands. Smaller areas occur west of Cook Inlet and on Hagemeister Island in Bristol Bay. Elevations range from sea level to 3,000 feet (900 m).

***Figure 14.*—Grasses, alder, and associated plants cover hilly Dystric Cryandepts. Kodiak Island.**

Most of the hills and foot slopes are covered by deep and moderately deep volcanic ash over glacial till or cinders. Depressions are filled with fibrous peat.

In most areas the vegetation is dominantly grasses and alder. Some areas in the north are forested and low tundra plants grow at high elevations. Sedges and other water-tolerant plants grow in depressions.

Most of the area is too steep for crops, but grasses and vegetables can be grown on included level to moderately sloping patches, especially in valley bottoms. Most of the area is suitable as rangeland, but there is a serious conflict with brown bears on Kodiak Island and the Alaska Peninsula. The forested areas contain much harvestable timber. Steep hillsides and flooding in valley bottoms create severe limitations for most kinds of construction.

Principal components:

Dystric Cryandepts, loamy, hilly to steep, (80 percent) are well drained thixotropic ashy soils. The dominant vegetation is grass, alder, and associated forbs and shrubs. Low tundra shrubs occur at high elevations. Some areas are forested.

Typically, under a thin mat of partially decomposed alder leaves and straw, these soils have a very dusky red or black thixotropic upper horizon over a dark reddish brown thixotropic horizon. Gravelly glacial till, weathered bedrock, cindery ash deposits, or sandy or gravelly alluvium may occur below 30 inches (75 cm). In the northern part of the Kodiak Island group, 4 to 12 inches of fresh silty and sandy volcanic ash make up the uppermost horizon. The soils are normally very strongly acid. See *51a, 51b, and 51c* in table 6.

Fluvaquentic Cryofibrists, nearly level, (10 percent) are very poorly drained fibrous sedge peat soils in depressions in foot slopes and hills. The vegetation is dominantly sedges and mosses.

Typically, the soils consist of dark brown sedge peat more than 5 feet (150 cm) deep. Seams and patches of ash are common. See *27* in table 6.

Dystric Lithic Cryandepts, loamy, hilly to steep, (5 percent) are well drained soils on high ridges and mountain foot slopes. They are similar to the Dystric Cryandepts except that they are less than 20 inches (50 cm) thick over consolidated bedrock and may contain rock fragments. They support grasses and alder at elevations up to about 1,000 feet (300 m) and alpine tundra vegetation at higher elevations. See *52* in table 6.

Other components (5 percent):

Andic Cryaquepts, loamy, nearly level to rolling, are somewhat poorly drained to poorly drained soils on valley bottoms and in depressions in uplands. They consist of dark brown to black thixotropic material over a very gravelly substratum. The vegetation is grasses, alder, cottonwood, and willows in valley bottoms and sedges and mosses in upland depressions. See *61* in table 6.

Andaqueptic Cryaquents, loamy, nearly level, are poorly drained mottled soils formed entirely in accumulations of recent volcanic ash in valley bottoms. The vegetation is mostly grasses and sedges. See *6* in table 6.

Andeptic Cryorthents, very gravelly, nearly level to rolling, consist of 8 to 12 inches (20 to 30 cm) of recent volcanic ash over very gravelly sand. They are on beach ridges. The vegetation is mostly grasses. See *14* in table 6.

IA15—Dystric Cryandepts, loamy, hilly to steep-Fluvaquentic Borohemists, nearly level association is in the following major land resource areas:

	Acres
170 Cook Inlet-Susitna Lowland	765,000
171 Alaska Peninsula and Southwestern Islands	47,000
Total	812,000

This association occupies foot slopes and both glaciated and nonglaciated hills on both sides of Cook Inlet (fig. 15) and in a small area near Port Moller on the Alaska Peninsula. Elevations range from nearly sea level to 3,000 feet (900 m) on some ridges. The area is covered by volcanic ash. In most places the ash overlies gravelly glacial till, but at elevations below 1,500 feet (450 m) in the southern Kenai Peninsula it overlies layered soft sandstone and shale. Depressions and level benches in hills have deep organic soils that contain lenses of ash. Most areas are covered with grasses and associated forbs and shrubs, clumps of Sitka spruce, and patches of alder and willows. Hills and ridges above 2,000 feet are covered with alpine tundra consisting mostly of low shrubs.

Poorly drained soils support black spruce, alder, willow, and sedges. The well drained soils are mostly too steep for farming, but included soils on gentle to moderate slopes can be used for grass and vegetable crops. The soils are suitable for rangeland. Trees in the association are of harvestable size but are generally sparse. Steep slopes or wetness severely limit the use of most soils for roads, buildings, and other construction.

Principal components:

Dystric Cryandepts, loamy, hilly to steep, (50 percent) are well drained soils on foot slopes and hills. They range in elevation from about 800 to 2,000 feet (240 to 600 m). The dominant vegetation is grasses and associated plants, clumps of Sitka spruce, and patches of willow and alder.

Typically, under a thin mat of decomposed organic matter, the soils have fine thixotropic black and reddish brown upper horizons over dark brown and yellowish brown thixotropic horizons that extend to depths of 20 to 40 inches (50 to 100 cm). The substratum ranges from very gravelly loam to stratified sand, silt loam, and clay. The soils are very strongly acid. See *51a* and *51b* in table 6.

Fluvaquentic Borohemists, nearly level, (20 percent) are very poorly drained fibrous organic soils in depressions on high benches and in drainageways. The dominant vegetation is sedges, willows, and sphagnum moss. The soils are dark brown, partially decomposed sedge peat. Seams and patches of volcanic ash are common. See *35* in table 6.

Typic Cryorthods, loamy, hilly to steep, (15 percent) are well drained, shallow to moderately deep silty soils over gravelly till. They occur under alpine tundra vegetation, including willows, lichens, and low shrubs and forbs, on hills and ridges above 2,000 feet (600 m) and under Sitka spruce on moraines at lower elevations.

Figure 15.—Grasses and alder with patches of Sitka spruce on hilly Dystric Cryandepts. Sedge-covered Fluvaquentic Borohemists occupy depressions and some long gentle slopes. Typic Cryorthods are on forested moraine-knolls in background. North of Homer.

Typically, under a thin mat of organic matter, the soils have a thin dark gray silt loam albic horizon over a very dusky red and dark reddish brown thixotropic spodic horizon that grades with depth to brown. A substratum of very gravelly loam commonly occurs at depths of 20 to 40 inches (50 to 100 cm). The soils are very strongly acid. See *121* in table 6.

Typic Cryaquepts, loamy, nearly level to rolling, (10 percent) are poorly drained silty and sandy soils in drainageways and on the borders of muskegs. The vegetation includes black spruce, alder, willows, grasses, and sedges. Typically, under a thin mat of decomposing organic material, the soils have a dark brown silt loam upper horizon over olive or olive brown mottled silt loam or stratified silty and sandy material. A substratum of very gravelly sand commonly occurs at depths ranging from 15 to 30 inches (40 to 75 cm). The soils are normally strongly acid. See *55a* and *55b* in table 6.

Typic Cryandepts, loamy, nearly level to rolling, (5 percent) are well drained soils on benches, gentle footslopes, and rolling hills covered mainly by grasses, alders, and scattered clumps of trees. The soils formed in a thick mantle of silty loess and volcanic ash over glacial till or soft sedimentary rock. Typically, beneath a mat of partially decomposed organic matter, the soils have a dark reddish upper layer that grades with depth to dark yellowish brown or grayish brown. In places, a thin discontinuous gray layer is directly beneath the organic mat. See *44* in table 6.

IA16—Dystric Cryandepts, loamy, hilly to steep-Rough mountainous land association is in the following major land resource areas:

	Acres
171 Alaska Peninsula and Southwestern Islands	1,994,000
175 Kuskokwim Highlands	54,000
Total	2,048,000

This association occupies parts of Kodiak Island (fig. 16), the Alaska Peninsula and adjacent islands, and islands in the northern part of Bristol Bay. Elevations range from sea level to more than 4,400 feet (1,350 m) on Kodiak Island. All of these areas exhibit features typical of glaciated landscapes. The coastline is very irregular, characterized by sea cliffs and many narrow, steep-walled bays. The valleys have hilly to steep sides and gently sloping valley bottoms filled with gravelly outwash deposits. Deeply dissected glacial moraine deposits cover the lower slopes of the valley walls. Most of the area between the valleys is steep and rocky. Volcanic ash blankets most of the area except the highest ridges and peaks. The ash varies in thickness from only a few inches at higher elevations to more than 3 feet (90 cm) in places at the lower elevations.

The vegetation of Afognak Island and the northern part of Kodiak Island is dominantly a forest of Sitka spruce. In other areas, the hillsides and mountain foot slopes support tall grasses, forbs, alder, and other shrubs. In valley bottoms the vegetation includes tall grasses, forbs, and some cottonwood and willow. The highest parts of the mountains support a sparse cover of low shrubs, forbs, and grasses or are nearly barren.

Forested parts of the association produce harvestable timber. Other vegetated areas are suitable for rangeland. Except in the valley bottoms, steep slopes severely limit most other uses.

Principal components:

Dystric Cryandepts, loamy, hilly to steep, (40 percent) are well drained loamy soils on mountain foot slopes and steep hills. They developed in strongly acid

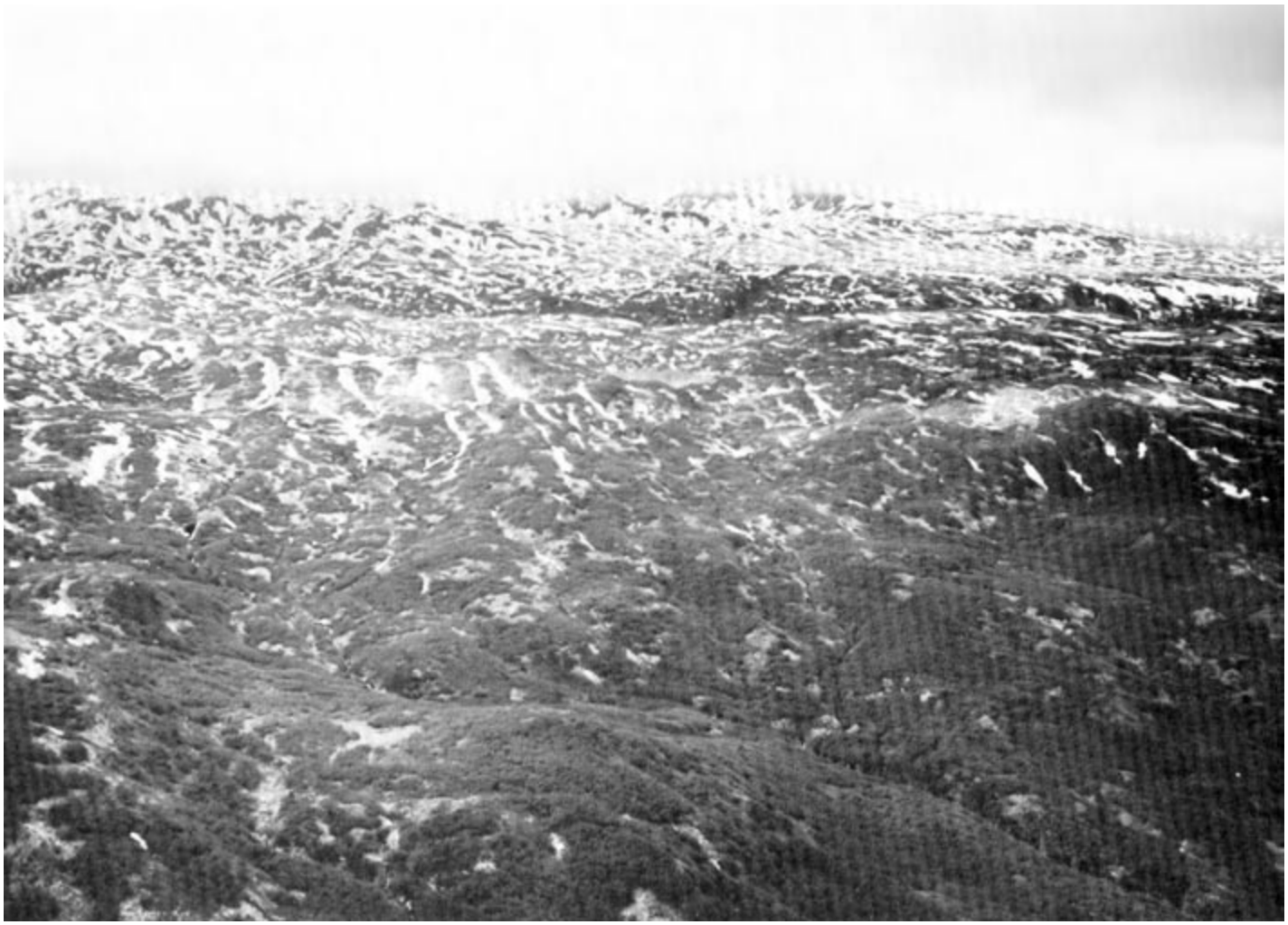

Figure 16.—Dystric Cryandepts and Dystric Lithic Cryandepts occupy hills that support a dense cover of alder, grasses, and associated plants. The Rough mountainous land at higher elevations has very thin or no soil cover. Kodiak Island.

fine volcanic ash, mostly underlain by gravelly glacial till. They support a forest of Sitka spruce, shrubs, and grass, or, at some higher elevations, low tundra species. The fine ash, to a depth of 20 to 40 inches (50 to 100 cm), is strongly thixotropic. Colors range from dark reddish brown at the surface to dark brown in deeper layers. In the northern part of the Kodiak Island group, fresh silty and sandy ash up to 12 inches (30 cm) thick covers the soil. The underlying material is commonly gravelly silt loam or sandy loam. See *51b* and *51c* in table 6.

Dystric Lithic Cryandepts, loamy, hilly to steep, (30 percent) are well drained loamy soils on steep lower slopes of mountains. They formed in volcanic ash over bedrock. The vegetation is grasses, alder, and other forbs and shrubs or dominantly low shrubs. Typically, under a mat of roots containing patches and lenses of fresh ash, the soils have dark reddish brown to dark brown layers of fine thixotropic ash underlain by very stony loam. Bedrock is at a depth of 10 to 20 inches (25 to 50 cm). See *52* in table 6.

Rough mountainous land (30 percent) occurs on steep ridges and peaks of hills and mountains where there is little or no vegetation. Bare rock and loose rubble dominate the area. A few small areas of very gravelly loam support a sparse cover of alpine tundra species. See *145* in table 6.

IA17—Dystric Lithic Cryandepts, loamy, hilly to steep association is in the following major land resource area:

	Acres
171 Alaska Peninsula and Southwestern Islands	533,000

This association occupies an area between the southeast shore of Iliamna Lake and Kamishak Bay of the Gulf of Alaska (fig. 17). This area of hills and ridges ranges in elevation from nearly sea level to a few peaks above 3,000 feet (900 m). The hills and ridges are covered with a thin layer of volcanic ash over metamorphic bedrock or, in places, gravelly till. Depressions are filled with fibrous peat containing lenses of volcanic ash.

The vegetation on low rounded hills is mainly low shrubs and grasses. Patches of white spruce and Sitka

***Figure 17.*—Dystric Lithic Cryandepts under alder, willow, and grasses occupy most uplands. Barren rock outcrops are common. Near Gibraltor Lake.**

spruce occur at lower elevations. Sedges and mosses grow in depressions.

Principal components:

Dystric Lithic Cryandepts, loamy, hilly to steep, (85 percent) are well drained soils formed in fine thixotropic ash over shallow bedrock. They occur on low hills bordering mountainous areas. The dominant vegetation is low shrubs and grasses. White spruce occurs on foot slopes bordering Iliamna Lake, and Sitka spruce on those that border Kamishak Bay. Typically, under a thin layer of partially decomposed organic material, the soils consist of dark reddish brown and dark brown fine thixotropic ash over dark brown very stony loam. Bedrock occurs within 20 inches (50 cm) of the surface. Exposures of bedrock are common. See *52* in table 6.

Typic Cryandepts, very gravelly, hilly to steep, (10 percent) are well drained soils formed in a shallow deposit of fine thixotropic ash over very stony glacial till. They occupy parts of foot slopes under a forest of white spruce and black spruce or, in areas bordering Kamishak Bay, Sitka spruce. The soils consist of 10 to 20 inches (25 to 50 cm) of dark reddish brown and dark brown fine thixotropic ash over a substratum of very stony loam. See *49a* in table 6.

Fluvaquentic Cryofibrists, nearly level, (5 percent) are very poorly drained fibrous organic soils in depressions on uplands and valley bottoms. The vegetation is dominantly sedges and mosses. The soils consist of fibrous sedge peat more than 50 inches (125 cm) thick over a very gravelly substratum. Lenses of volcanic ash are common within the peat. See *27* in table 6.

IQ1—Histic Pergelic Cryaquepts, clayey, nearly level to rolling association is in the following major land resource area:

		Acres
172	Copper River Plateau	1,752,000

This association occupies the site of a large lake that existed during glacial times (fig. 18). A nearly level to rolling plain dotted with lakes and muskegs dominates the landscape, but the flood plains and terraces of major streams, scattered hilly moraines, and a few alpine peaks are included. Elevations range from about

Figure 18.—Clayey Histic Pergelic Cryaquepts occupy the site of a large glacial lake in the Copper River Plateau. Pergelic Cryofibrists occur in depressions, usually bordering shallow lakes. Near Glennallen.

1,500 to 3,000 feet (450 to 900 m) above sea level. Although the overall drainage pattern is poorly defined, the lower stretches of a few large rivers fed by meltwater from glaciers in the adjoining mountains are deeply incised in narrow valleys. Most of the association drains into the Copper River system, but streams in the western part of the area are tributaries of the Susitna River.

The major soils formed in clayey, nonacid to calcareous, glaciolacustrine sediment. Included are small areas of soils in very gravelly drift on terraces and moraines, stratified silty and sandy alluvial sediment on flood plains, and sand in old beach ridges and stabilized dunes. Organic soils occupy some depressions. Terraces near the larger rivers are commonly mantled with silty loess. Permafrost is shallow in most of the area but is deep or absent in some of the very gravelly and sandy material.

The vegetation is mainly black spruce forest interspersed with large areas of brushy tundra and scattered areas of sedges, mosses, and low shrubs in very poorly drained muskegs. At lower elevations there are a few forests of white spruce on south-facing slopes and on gravelly terraces and moraines. Stands of cottonwood and tall brush are common on the larger flood plains, and alpine forbs and shrubs occur on isolated ridgetops.

The climatic and soil limitations are too severe for most crops and commercial timber. Most of the soils also have severe limitations for roads and building foundations, largely because of permafrost. The best construction sites are on very gravelly moraines and on narrow terraces that border the major streams. The area provides a wide variety of wildlife habitat that is utilized by many different species, including moose and caribou.

Principal components:

Histic Pergelic Cryaquepts, clayey, nearly level, (60 percent) occupy a series of nearly level plains separated by short escarpments in a broad former lake basin. Gradients are generally less than 3 percent. The soils are poorly drained and formed in nonacid to calcareous clayey glaciolacustrine sediment over a shallow permafrost table. The principal vegetation is black spruce, mosses, sedges, dwarf birch, willow, alder, and low shrubs. Typically, these soils have a thick peaty surface mat over mottled gray clay or clay loam. Under the natural vegetation the permafrost table is usually less than 20 inches (50 cm) below the mineral surface, but if the vegetation is removed or destroyed the permafrost table is lowered. During the summer the soil above the frozen material is usually wet. See *64* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (15 percent) occupy long foot slopes of moraines and small isolated mountains. Solifluction lobes are fairly common. The soils, formed in silty colluvium or loess, are poorly drained and have a shallow permafrost table. The dominant vegetation is black spruce, mosses, sedges, willow, dwarf birch, and other low shrubs.

Typically, these soils have a thick peaty surface mat over gray or dark gray mottled silt loam that is perennially frozen at depths ranging from 15 to 30 inches (40 to 75 cm) below the mineral surface. During the summer thaw water perched above the frozen material keeps the soils wet. In places the soils contain a few stones and pebbles. See *65a* in table 6.

Pergelic Cryofibrists, nearly level, (10 percent) are very poorly drained, nearly level organic soils in low areas and depressions in undulating to rolling plains. The peat consists of fibrous material derived mainly from sedges. Sphagnum moss peat is at the surface. The permafrost table is generally shallow. See *28* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, (5 percent) occupy high moraines and other hills above the tree line. Gradients range from 12 to 45 percent. The soils are well drained. They formed in very gravelly glacial drift that is commonly capped with a thin mantle of silty loess. Although the substratum below a depth of about 40 inches (100 cm) is probably perennially frozen, the very gravelly material generally does not retain enough moisture for thick ice lenses to form. The dominant vegetation is willow, dwarf birch, low shrubs, mosses, lichens, short grasses, and, at the tree line, scattered white spruce.

Under an acid surface mat of organic material, the soils have a thin gray albic horizon over a dark reddish brown to dark brown spodic horizon that is about 5 to 10 inches (12 to 25 cm) thick. The texture generally ranges from silt loam to gravelly sandy loam in the upper 5 to 15 (12 to 40 cm) inches and from very gravelly loam to very gravelly coarse sand in the underlying material. See *137* in table 6.

Other components (10 percent):

Pergelic Cryaquepts, loamy, nearly level to rolling, are poorly drained soils on foot slopes and in broad valleys. The vegetation is dominated by black spruce. Permafrost is shallow to moderately deep. See *72b* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, are well drained, gray soils on upper slopes of alpine ridges. They have sparse shrubby vegetation. See *20* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, are well drained soils with a dark upper horizon on slopes above tree line. The vegetation is dominated by low shrubs. See *100* in table 6.

Typic Cryochrepts, very gravelly, hilly to steep, are well drained soils with a brown cambic horizon on slopes facing directly south. They support a mixed forest of white spruce, paper birch, and aspen. See *86* in table 6.

Typic Cryofluvents, loamy, nearly level, are well drained stratified soils on low terraces bordering flood plains. They support a forest of white spruce and cottonwood. See *7b* in table 6.

Typic Cryopsamments, sandy, hilly to steep, are well drained, gray sandy soils on old beach ridges and low dunes. They support a forest of white spruce and aspen. See *22* in table 6.

IQ2—Histic Pergelic Cryaquepts, loamy, nearly level to rolling association is in the following major land resource areas:

	Acres
172 Copper River Plateau	933,000
173 Alaska Range	98,000

		Acres
174	Interior Alaska Lowlands	7,451,000
175	Kuskokwim Highlands	7,606,000
176	Interior Alaska Highlands	9,072,000
177	Norton Sound Highlands	2,449,000
178	Western Alaska Coastal Plains and Deltas	3,566,000
180	Brooks Range	322,000
181	Arctic Foothills	15,618,000
	Total	47,115,000

This association is extensive and widespread in all regions of Alaska within the permafrost zone. Although the dominant soils have similar characteristics, there are some differences in associated soils of relatively minor extent, soil patterns, landforms, and landscape features.

Largely because of ice-rich permafrost, the dominant soils in all areas of the association have severe limitations for any intensive use and development. They are not potentially suitable for common agricultural crops and are not forested. Primarily the soils provide habitat for wildlife. Many provide suitable grazing for reindeer.

On the COPPER RIVER PLATEAU and the ALASKA RANGE the association occupies extensive tracts of nearly level to rolling ground moraines, outwash plains, and long mountain foot slopes. Some moraine hills, small flood plains, and a few stream terraces are included. Elevations range from about 2,000 to 3,000 feet (600 to 900 m) above sea level. Forests of black spruce and tundra dominated by sedges, mosses, and low shrubs, are the two principal kinds of vegetation, though a few forests of white spruce, paper birch, and aspen occur on south-facing slopes of very gravelly moraines. The dominant soils in the association are developed in silty material of variable thickness over very gravelly glacial drift. Most of the soils have a shallow permafrost table, but in some of the very gravelly well drained soils permafrost is deep or absent.

Principal components in the Copper River Plateau and the Alaska Range:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (55 percent) occur on nearly level to rolling ground moraines and long foot slopes of low mountains. The soils are poorly drained and have a shallow permafrost table. They consist of moderately deep to deep loamy colluvium or loess over gravelly and stony glacial drift. The principal types of vegetation are lowland tundra and black spruce forest. The soils have a thick peaty surface mat and a mottled gray silt loam to sandy loam lower horizon. The permafrost table is usually 10 to 20 inches (25 to 50 cm) below the surface mat. Some of the soils are as much as 35 percent gravel by volume. See *65a* in table 6.

Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling, (10 percent) are poorly drained soils on scattered outwash plains and a few moraines. They formed in very gravelly glacial drift and have a moderately deep permafrost table. They support forests of black spruce and tundra dominated by sedges, mosses, and low shrubs. Beneath a thick peaty surface mat, the soils are mottled dark gray very gravelly loam or sandy loam. They are perennially frozen below a depth of 20 to 30 inches (50 to 75 cm). See *68* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, (10 percent) are well drained soils on scattered low moraine hills. The vegetation is dwarf birch, grasses, low shrubs, lichens, and scattered white spruce. The soils have a thin gray albic horizon and a reddish brown to brown spodic horizon about 8 to 12 inches (20 to 30 cm) thick. They developed in very gravelly silt loam to sandy loam glacial drift. Although the mean annual soil temperature is below freezing, the soils generally do not retain enough moisture for large ice lenses to form. See *137* in table 6.

Pergelic Cryofibrists, nearly level, (10 percent) occupy nearly level muskegs that are wet and spongy in the summer. The soils consist of fibrous moss and sedge peat that extends into ice-rich permafrost at depths of 10 to 30 inches (25 to 75 cm) below the surface. The dominant vegetation is sedges, mosses, and low shrubs. See *28* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, (10 percent) are poorly drained soils with a moderately deep permafrost table. They are on low moraines. They occur in close association with Histic Pergelic Cryaquepts. The soils formed in very gravelly and stony glacial till. They have a thin peaty surface mat and a mottled dark gray cambic horizon developed in very gravelly loam. Depth to permafrost ranges from about 20 to 30 inches (50 to 75 cm). The vegetation is mainly shrubs, sedges, lichens, mosses, and black spruce. See *76* in table 6.

Other components (5 percent):

Typic Cryorthods, very gravelly, hilly to steep, have thin albic and spodic horizons. They occupy south-facing slopes of moraines at low elevations. They are well drained soils that support a forest of white spruce, paper birch, and aspen. See *125c* in table 6.

Typic Cryochrepts, very gravelly, nearly level to rolling, occur on terraces along the Copper River. They are well drained soils developed in loess over gravel. They support a forest of white spruce, paper birch, and aspen. See *85a* in table 6.

In the INTERIOR ALASKA LOWLANDS the association occupies broad valleys and lowlands bordering major rivers and their tributaries (fig. 19). Low foot slopes of adjacent uplands are included. Elevations range from about 500 feet (150 m) above sea level in lower parts of major river valleys to about 2,000 feet (600 m) on terraces and foot slopes in the upper Yukon and Tanana River Valleys. Most of the soils formed in silty alluvium and loess derived from the flood plains of large rivers. The dominant soils are shallow over ice-rich permafrost, but in a few well drained soils on terraces the permafrost is deep or absent. The two principal types of vegetation are black spruce forest and tundra that is mainly sedge tussocks, mosses, and shrubs. The black spruce forest generally has a thick ground cover of moss.

Principal components in the Interior Alaska Lowlands:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (60 percent) are poorly drained soils with a shallow permafrost table on low terraces in broad valleys and on long foot slopes. They developed in deep

Figure 19.—Loamy Histic Pergelic Cryaquepts and Pergelic Cryaquepts on broad lowland in Tanana Valley near Fairbanks. Pergelic Cryofibrists in depressions near small lakes and Typic Cryofluvents on forested narrow levees along streams. Typic Cryochrepts and Aeric Cryaquepts on low hills in background.

silty loess and alluvium. The vegetation is sedges, mosses, shrubs, and forests of black spruce. The soils have a thick peaty surface mat over mottled dark gray silt loam. Depth to ice-rich perennially frozen material is 10 to 20 inches (25 to 50 cm). See *65a* in table 6.

Pergelic Cryaquepts, loamy, nearly level to rolling, (15 percent) are poorly drained soils on low terraces and foot slopes in close association with Histic Pergelic Cryaquepts. They formed in deep silty material. The vegetation is mainly willows, alder, dwarf birch, sedges, mosses, low shrubs, and scattered black spruce. The soils have a thin peaty surface mat over mottled gray silt loam. Depth to ice-rich permafrost is 20 to 30 inches (50 to 75 cm). See *72a* in table 6.

Typic Cryochrepts, loamy, nearly level to rolling, (10 percent) are well drained soils on terraces and low bluffs along major rivers. They formed in thick deposits of silty loess. Permafrost is either deep or absent. The principal vegetation is a forest of white spruce, paper birch, and quaking aspen. The soils have a thin organic surface mat and a brown silt loam horizon about 10 to 18 inches (25 to 45 cm) thick over olive gray silt loam or fine sandy loam. Most of the soils are nonacid. Some have a calcareous substratum. See *81b* in table 6.

Pergelic Cryofibrists, nearly level, (5 percent) consist of very poorly drained peat with a shallow permafrost table. They are in depressions in the lowlands. The vegetation is mainly sedges, mosses, and low shrubs. The peat consists mainly of dark brown sedge fibers. Depth to ice-rich permafrost ranges from about 10 to 30 inches (25 to 75 cm). The peat above the permafrost is saturated throughout the summer. See *28* in table 6.

Aeric Cryaquepts, loamy, nearly level to rolling, (5 percent) are somewhat poorly drained deep silty soils on terraces and long low foot slopes. They are commonly underlain at a great depth by large isolated masses of clear ice or frozen material. The vegetation is either a forest of white spruce and paper birch or a forest of black spruce with a ground cover of moss. Beneath a mat of moss and forest litter the soils have a mottled dark grayish brown silt loam horizon about 10 to 20 inches (25 to 50 cm) thick over mottled olive gray silt loam. Some of the soils are underlain by very gravelly sand at depths of 30 to 40 inches (75 to 100 cm). See *58* in table 6.

Other components (5 percent):

Typic Cryofluvents, loamy, nearly level, are well drained stratified silty and sandy soils on natural levees and low terraces bordering major streams. They support a forest dominated by white spruce, cottonwood, and paper birch. See *7a* in table 6.

Typic Cryorthents, loamy, nearly level to rolling, are well drained, deep, silty soils on terraces along rivers. They are covered mostly by cottonwood, white spruce, and paper birch. See *10a* in table 6.

In the KUSKOKWIM HIGHLANDS and the INTERIOR ALASKA HIGHLANDS the association occupies broad sloping uplands. Elevations range from about 1,000 to 3,000 feet (300 to 900 m) above sea level. The dominant soils formed in thick silty colluvial sediment over partially weathered bedrock and have a shallow permafrost table. The vegetation is mainly sedge tussocks, mosses, shrubs, and scattered forests of black spruce.

Principal components in the Kuskokwim Highlands and the Interior Alaska Highlands:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (60 percent) are poorly drained soils with shallow permafrost on rolling uplands and long foot slopes. They formed in thick deposits of silty colluvium but, in places, contain a few stones and pebbles. The vegetation is mainly sedge tussocks, mosses, shrubs, willows, dwarf birch, and scattered forests of black spruce. The soils have a thick peaty surface mat over mottled dark gray silt loam that commonly contains black streaks of buried organic matter. Depth to ice-rich perennially frozen silty material ranges from about 10 to 20 inches (25 to 50 cm). See *65a* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, (10 percent) are poorly drained soils with permafrost on the upper slopes of low hills and ridges. They formed in very gravelly and stony colluvium and residual material over weathered bedrock. The vegetation is mainly sedges, mosses, willows, dwarf birch, and other low shrubs. The soils have a thin peaty surface mat over mottled, dark gray very gravelly and stony silt loam or sandy loam. Depth to perennially frozen material ranges from about 20 to 30 inches (50 to 75 cm). See *76* in table 6.

Typic Cryochrepts, loamy, hilly to steep, (10 percent) are well drained silty soils on south-facing slopes of low hills near major rivers. They formed in a thick mantle of loess over weathered bedrock and support forests of paper birch, white spruce, and quaking aspen. Beneath a thin mat of forest litter, the soils have a dark brown to brown silt loam cambic horizon 12 to 18 inches (30 to 45 cm) thick over olive silt loam. See *82* in table 6.

Typic Cryorthods, loamy, hilly to steep, (10 percent) are well drained soils on south-facing slopes of low hills near the Brooks Range and in the Kuskokwim Highlands south and west of McGrath. The soils developed in silty loess more than 30 inches (75 cm) thick over weathered bedrock. They support forests of white spruce, paper birch, and aspen. Under a surface mat of forest litter, the soils have a thin gray albic horizon and a reddish brown to brown silt loam spodic horizon 10 to 18 inches (25 to 45 cm) thick over olive silt loam. See *121* in table 6.

Aeric Cryaquepts, loamy, nearly level to rolling, (5 percent) are somewhat poorly drained soils on long foot slopes. They developed in deep silty material and are commonly underlain by isolated masses of ice and frozen earth. The vegetation is a forest of either black spruce or white spruce and paper birch. Under a mat of forest litter, the soils have a mottled grayish brown silt loam horizon 10 to 20 inches (25 to 50 cm) thick over olive gray silt loam. See *58* in table 6.

Other components (5 percent):

Pergelic Cryofibrists, nearly level, consist of very poorly drained fibrous peat in depressions in valley bottoms. Permafrost is shallow. See *28* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, are well drained gray soils on a few narrow ridgetops. The vegetation is low shrubs, mosses, grasses, and lichens. See *20* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, are well drained soils on broad ridges. The upper layer of the soil is dark and enriched with organic matter. The vegetation is tundra dominated by shrubs and grasses. See *100* in table 6.

In the NORTON SOUND HIGHLANDS the association occupies broad basins, valleys, and low rolling plateaus. Elevations range from near sea level to about 2,500 feet (750 m). The dominant soils formed in thick silty colluvial deposits, but some soils on low rounded ridges formed in gravelly and stony residual material over partially weathered bedrock. Practically all of the soils are shallow over permafrost. Solifluction lobes on long foot slopes and frost-scarred areas on low rounded ridges are common features of the landscape. A few areas have a polygonal surface pattern. The vegetation is tundra dominated by sedges, mosses, lichens, and low shrubs.

Principal components in the Norton Sound Highlands:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (70 percent) are poorly drained soils with a shallow permafrost table that occupy sloping valleys, long foot slopes of low hills, and broad basins. They developed in silty colluvial material and support tundra vegetation dominated by sedge tussocks, mosses, and low shrubs. A few areas in basins have a polygonal surface pattern. The soils have a thick peaty surface mat over mottled dark gray silt loam. Depth to ice-rich permafrost ranges from about 10 to 20 inches (25 to 50 cm). See *65b* in table 6.

Pergelic Cryaquepts, very gravelly, nearly level to rolling, (10 percent) are poorly drained soils with a moderately deep permafrost table on broad low ridges. They formed in very gravelly and stony loam or silt loam weathered from the underlying bedrock. The vegetation is mainly sedges, mosses, lichens, and low shrubs. Many included frost-scarred areas are nearly bare. Both vegetated and nonvegetated soils have mottled dark gray horizons. Depth to permafrost commonly ranges from 20 to 30 inches (50 to 75 cm). See *75* in table 6.

Pergelic Ruptic-Histic Cryaquepts, very gravelly, nearly level to rolling, (10 percent) are poorly drained soils on the upper slopes of low hills and ridges. They have a striped surface pattern consisting of narrow parallel troughs and ridges that are nearly perpendicular to the slope. The vegetation is sedges, mosses, lichens, and low shrubs. In the troughs, which are about 6 inches (15 cm) deep and 2 to 3 feet (60 to 90 cm) wide, the soils have a thick peaty surface mat and a shallow permafrost table. On the narrow ridges between the troughs the organic surface mat is much thinner and the permafrost table is deeper. Beneath the surface mat the soils are mottled, dark gray, very gravelly silt loam or loam. Depth to permafrost is 6 to 10 inches (15 to 25 cm) in the troughs and 20 to 40 inches (50 to 100 cm) on the ridges. See *79* in table 6.

Pergelic Cryofibrists, nearly level, (5 percent) consist of very poorly drained peat of nearly level valley bottoms and basins. They have a shallow permafrost table and are wet and spongy above the permafrost in the summer. Sedges, mosses, and low shrubs are the dominant plants. The peat material consists mainly of dark brown sedge and moss fibers that are perennially frozen below depths of 10 to 20 inches (25 to 50 cm). See *28* in table 6.

Other components (5 percent):

Pergelic Cryorthents, very gravelly, hilly to steep, are well drained gray soils on the tops of a few low knolls and ridges. The vegetation is sparse and is dominated by low shrubs. See *20* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, are well drained soils on the upper slopes of low ridges. They have an umbric epipedon 6 to 10 inches (15 to 25 cm) thick. The vegetation is dominated by low shrubs. See *100* in table 6.

In the WESTERN ALASKA COASTAL PLAINS AND DELTAS the association occupies extensive plains that border the Bering Sea. Elevations on these nearly level plains seldom exceed 100 feet (30 m) above sea level. Many meandering streams and shallow lakes are a part of the landscape. Nearly all of the soils formed in silty alluvial sediment and have a shallow permafrost table. The vegetation is tundra dominated by sedges, mosses, and low shrubs.

Principal components in the Western Alaska Coastal Plains and Deltas:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (70 percent) are poorly drained soils on broad low plains. They formed in deep silty alluvial sediment and are shallow over permafrost. The vegetation is tundra consisting of sedges, mosses, lichens, and low shrubs. Beneath a thick peaty surface mat, the soils have a mottled, dark gray silt loam horizon that is commonly streaked with frost-churned organic material. A few soils have a polygonal surface pattern. See *65b* in table 6.

Pergelic Cryofibrists, nearly level, (15 percent) are very poorly drained organic soils in nearly level shallow basins and slight depressions. Permafrost is shallow, and the peat above the permafrost is wet and spongy in the summer. The vegetation is mainly sedges and mosses. Beneath a thick mat of living moss, sedge, and roots, the peat consists of dark brown sedge and moss fibers that are perennially frozen below depths of 10 to 20 inches (25 to 50 cm). See *28* in table 6.

Pergelic Cryaquepts, loamy, nearly level, (10 percent) are poorly drained soils with permafrost on low terraces near major streams. They support willows, sedges, mosses, and low shrubs. Beneath a thin peaty surface mat, the soils have a mottled, dark gray horizon formed in stratified silt and fine sand. Depth to permafrost ranges from 20 to 40 inches (50 to 100 cm). See *72b* in table 6.

Other components (5 percent):

Typic Cryofluvents, loamy, nearly level, occur on a few narrow natural levees. They are well drained, stratified silt and fine sand. The vegetation is mainly willows, alder, and grasses. See *7c* in table 6.

Typic Cryopsamments, sandy, hilly to steep, occur on low sand dunes along the coast. The vegetation is mainly grasses and forbs. See *22* in table 6.

In the BROOKS RANGE and the ARCTIC FOOTHILLS the association occupies broad valleys, basins, foot slopes, and low rolling piedmont hills (fig. 20). Most areas are patterned with polygons, stripes, and some circular frost scars. Elevations range from about 300 feet (90 m) above sea level near the coastal plains to 3,000 feet (900 m) on foot slopes of the Brooks Range. Most of the soils consist of silty colluvial and residual material weathered from fine-grained, nonacid sedimentary rocks. The vegetation is tundra dominated by sedges, mosses, lichens, and low shrubs.

Principal components in the Brooks Range and the Arctic Foothills:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (70 percent) are poorly drained soils that occupy broad sloping valleys, nearly level basins, low piedmont hills, and the low parts of mountain foot slopes north of the Brooks Range. The soils are shallow over permafrost. In valley bottoms and on the lower parts of long slopes most of the soils formed in thick deposits of nonacid silty colluvium. These soils commonly have a striped surface pattern on the slopes and a polygonal pattern on nearly level valley bottoms and basins. The soils that occupy higher slopes and low hills commonly formed in nonacid light silty clay loam derived from fine-grained sedimentary rock.

The vegetation is tundra dominated by sedge tussocks, mosses, lichens, and low shrubs. Beneath a thick peaty surface mat, the soils have a mottled, dark gray horizon with black streaks of frost-churned organic matter. Depth to ice-rich permafrost ranges from about 5 to 15 inches (12 to 40 cm). Immediately above the

Figure 20.—Loamy Histic Pergelic Cryaquepts in Arctic Foothills between the Brooks Range and the Colville River.

permafrost table, many of the soils have a thin layer darkened with organic material. Some soils on low hills contain a few angular stones and pebbles. See *65b* in table 6.

Pergelic Cryaquepts, loamy, nearly level to rolling, (10 percent) are poorly drained soils on the tops of low rounded knolls and ridges. They also occur on a few flood plains. The vegetation is sedges, mosses, and other low tundra plants. On the crests of knolls and ridges, nonvegetated and sparsely vegetated circular frost scars make up much of the surface. Both vegetated and nonvegetated soils in this position consist of mottled, dark gray gravelly silt loam or gravelly silty clay loam weathered from fine-grained sedimentary rock. The coarse fragments are commonly angular and make up about 10 to 35 percent of the soil volume. Depth to permafrost is about 5 to 15 inches (12 to 40 cm) beneath a thin peaty surface mat in the vegetated soils. It is about 15 to 30 inches (40 to 75 cm) in the nonvegetated frost scars. The nearly level soils on flood plains have mottled dark gray cambic horizons developed in stratified silt and fine sand. In these soils the permafrost table is generally 20 to 40 inches (50 to 100 cm) below the surface. See *72b* in table 6.

Pergelic Cryaquolls, loamy, nearly level to rolling, (10 percent) are poorly drained soils with a shallow permafrost table on lower foot slopes of some hills north of the Brooks Range. They occur in close association with other poorly drained soils and commonly have a weakly striped or polygonal surface pattern. The vegetation is sedges, mosses, lichens, and other low tundra plants. Beneath the mat of vegetation, the soils have 6 to 10 inches (15 to 25 cm) of black or very dark gray, nonacid silt loam or gravelly loam enriched with organic matter. The subsoil is mottled dark gray silt loam or gravelly loam. Depth to ice-rich permafrost is about 10 to 20 inches (25 to 50 cm) beneath the organic surface mat. See *101* in table 6.

Other components (10 percent):

Pergelic Cryaquepts, very gravelly, nearly level, are poorly drained soils with permafrost that occur on a few low narrow terraces bordering streams. See *75* in table 6.

Pergelic Cryorthents, very gravelly, nearly level to steep, are excessively drained gray soils on a few narrow terraces and a few sharp ridgetops. They are mostly nearly level or hilly to steep. See *19* and *20* in table 6.

Pergelic Cryochrepts, very gravelly, hilly to steep, are well drained soils with thin brown cambic horizons that occupy a few short south-facing slopes near the crest of low knolls. See *93* in table 6.

Pergelic Cryofibrists, nearly level, are very poorly drained organic soils in depressions in valley bottoms and basins (fig. 21). See *28* in table 6.

Pergelic Cryorthents, clayey, nearly level to rolling, are well drained deep clayey soils, generally dark in color, on rolling uplands. There are many barren frost scars. See *17* in table 6.

IQ3—Histic Pergelic Cryaquepts-Typic Cryofluvents, loamy, nearly level association is in the following major land resource areas:

	Acres
173 Alaska Range	76,000
174 Interior Alaska Lowlands	5,626,000
175 Kuskokwim Highlands	87,000
176 Interior Alaska Highlands	384,000
178 Western Alaska Coastal Plains and Deltas	852,000
181 Arctic Foothills	116,000
Total	7,141,000

This association occurs on flood plains of many major streams in interior and western Alaska. The largest of these border the Yukon and Kuskokwim Rivers in the Interior Alaska Lowlands (fig. 22), and the Yukon-Kuskokwim Delta part of the Western Alaska Coastal Plains and Deltas Major Land Resource Area. Others border tributary rivers in the Interior Alaska Highlands and Kuskokwim Highlands areas. A smaller area of this association borders the lower Noatak River in the Arctic Foothills Major Land Resource Area.

The soil pattern is essentially the same in all of these areas. Soils are of two basic kinds. On the lower parts of the flood plains are poorly drained soils with permafrost. On slightly higher natural levees are well drained soils in which permafrost is deep or absent. Because the rivers, over long periods, have shifted their channels in the flood plain, some levees are not adjacent to streams and in many places are miles away. Conversely, the present channels of the rivers are in places bordered by poorly drained soils which were formerly separated from them by natural levees. Most

Figure 21.—Typical surface pattern of Pergelic Cryofibrists in tundra areas.

Figure 22.—**Marshy Histic Pergelic Cryaquepts in meander scars and other low areas on Yukon flood plain and forested Typic Cryofluvents on natural levees. Pergelic Cryofibrists occupy areas surrounding small lakes. Near Beaver.**

areas of well drained soils are interrupted by narrow meander scars, but in many places these channels are neither numerous nor conspicuous. Most areas of this association are flooded occasionally. Flooding usually takes place in the spring, but in some years there is also flooding after prolonged midsummer rains.

Vegetation on the well drained soils is dominantly a forest of white spruce, paper birch, quaking aspen, cottonwood, and willows. In the Yukon-Kuskokwim Delta, however, willows and alder are the principal plants. The poorly drained soils are covered either by a black spruce forest or by sedge tussocks and associated low shrubs.

The well drained soils of natural levees are suitable for small grains, forage crops, and hardy vegetables in the Interior Alaska Lowlands, Kuskokwim Highlands, and Interior Alaska Highlands Major Land Resource Areas. Floods normally recede well before the spring planting season and are rare or of short duration in the summer growing season. These soils also support stands of white spruce suitable for commercial use. The poorly drained soils with permafrost have little potential for either agriculture or forestry.

Because of low summer temperatures only grasses and vegetables can be grown in the Alaska Range, Western Alaska Coastal Plains and Deltas, and Arctic Foothills Major Land Resource Areas. No commercial forestry is possible in those areas.

There are severe limitations for construction in all areas because of flooding and, in the poorly drained soils, permafrost. The association provides habitat for a large variety of wildlife, especially migratory waterfowl that use the wet areas for nesting.

Principal components:

Histic Pergelic Cryaquepts, loamy, nearly level, (45 percent) are poorly drained soils in low areas, including many meander scars, on the flood plains. They have thick surface organic horizons, derived principally from either sedges or sphagnum moss. Texture ranges from silt loam to sandy loam. Many of the soils are stratified. The soils are usually saturated above a shallow permafrost table, but some are dry in the upper horizons in midsummer. Both acid and nonacid soils are included. Along parts of the Yukon River and in a few other places the soils are calcareous. See *65a* and *65b* in table 6.

Typic Cryofluvents, loamy, nearly level, (35 percent) are well drained soils on natural levees along existing and former river channels. In many places the levees have coalesced into broad, gently undulating plains interrupted by meander scars containing poorly drained soils. The soils generally consist of stratified silt loam and fine sand, but some have uniform texture to great depth. In most cases, thin seams of organic material occur throughout the soil. Permafrost may occur at depths greater than 5 feet (150 cm) under some of these soils in areas where mean annual soil temperatures are below freezing. Such soils are properly classified as Pergelic Cryorthents, but because no information on soil temperatures is available they are included with the Typic Cryofluvents in this survey.

Most of the soils are nonacid. Many, especially on the flood plains of the Yukon and Kuskokwim Rivers, are calcareous at some depth. The vegetation is a forest of white spruce, birch, aspen, balsam poplar, and willows. Willows and alder are the principal plants in parts of the Yukon-Kuskokwim Delta west of the tree line. See *7a, 7b,* and *7c* in table 6.

Pergelic Cryofibrists, nearly level, (15 percent) are organic soils on slightly lower areas on the flood plains than the poorly drained mineral soils. They consist of thick deposits of very strongly acid moss peat, commonly with layers of fibrous sedge peat in the lower part. In places the organic soil is made up primarily of sedge peat with sphagnum moss only in the upper layer. The soils are underlain by permafrost at depths of 5 to 30 inches (12 to 75 cm).

Vegetation on these soils includes mosses, sedges, low shrubs, black spruce, and tamarack. Areas of organic soils commonly include small lakes or areas of freshwater marsh. See *28* in table 6.

Typic Cryorthents, very gravelly, nearly level, (5 percent) are on natural levees along some of the larger tributaries to the Yukon and Kuskokwim Rivers. They consist of stratified sandy and silty material underlain at a very shallow depth by a thick deposit of very gravelly sand. In other respects these soils are like the Typic Cryofluvents with which they are associated. See *12a, 12b,* and *12c,* in table 6.

IQ4—Histic Pergelic Cryaquepts-Typic Cryorthents, loamy, nearly level to rolling association is in the following major land resource areas:

	Acres
174 Interior Alaska Lowlands	76,000
176 Interior Alaska Highlands	1,098,000
Total	1,174,000

This association occupies parts of the Kanuti Flats and adjoining low rolling hills and terraces. The landscape is one of low rolling moraine hills and knolls, broad shallow depressions and drainageways, and some thaw lakes and small muskegs. A thick deposit of silty loess mantles the uplands. Elevation ranges from about 500 feet (150 m) on low terraces to about 1,700 feet (520 m) on the highest hills.

Permafrost underlies most of the area. On north-facing hillsides, on low toe slopes, and in broad depressions, the vegetation is dominated by black spruce, sedge tussocks, willows, low shrubs, and sphagnum moss. Low knolls and long south-facing hillsides support a forest of white spruce, paper birch, and alder. On steeper south-facing slopes and on ridges, the forest includes aspen and shrubs.

Because of climatic limitations, well drained soils of this association are only marginally suitable for agriculture or forestry. The well drained soils have few limitations for construction of roads and buildings, but poorly and very poorly drained soils have severe limitations for construction because of wetness and permafrost.

Principal components:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (60 percent) are poorly drained silty soils with permafrost that occupy long gentle foot slopes, north-facing hillsides, and broad depressions in terraces and valley bottoms. They formed in deep nonacid loess. The vegetative cover includes black spruce, shrubs, forbs, sedge tussocks, mosses, and lichens.

Typically, the soil has a thick mat of partly decomposed organic matter over mottled olive gray silt loam. The reaction is nonacid or alkaline. Permafrost is usually at a depth of less than 2 feet (60 cm). In the summer the material above the permafrost is usually saturated. See *65a* in table 6.

Typic Cryorthents, loamy, nearly level to rolling, (25 percent) are deep, well drained silty soils formed in calcareous loess. They occupy gentle to rolling slopes on low knolls and ridges and south-facing hillsides. They support a forest of white spruce, paper birch, and alder. On steeper slopes shrubs and aspen are mixed with white spruce and birch. Typically, the soils have a thin mat of forest litter underlain by olive gray silt loam that has a calcareous reaction. Permafrost may occur at depths greater than 5 feet (150 cm) in some of these soils. Such soils, if they exist, would properly be classified as Pergelic Cryorthents. Some stratification of loamy material occurs in knolls on low terraces. See *10a* in table 6.

Pergelic Cryofibrists, nearly level, (10 percent) are very poorly drained soils that consist of fibrous moss and sedge peat that has accumulated in shallow depressions. They occupy parts of low rolling terraces, broad shallow drainageways, and valley bottoms and support a dense cover of sedges and grasses and sphagnum moss.

Typically, these soils are extremely acid and are perennially frozen at a depth of less than 18 inches. The water table is always at or near the surface. See *28* in table 6.

Aeric Cryaquepts, loamy, nearly level to rolling, (5 percent) are moderately well drained to somewhat poorly drained silty soils on foot slopes of hills. They

support a forest of white spruce, paper birch, and quaking aspen. Typically, they are very strongly mottled gray silt loams. Masses of clear ice may occur at great depths. See *58* in table 6.

IQ5—Histic Pergelic Cryaquepts, loamy, nearly level to rolling-Pergelic Cryorthents, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
175 Interior Alaska Highlands	529,000
177 Norton Sound Highlands	1,015,000
180 Brooks Range	330,000
Total	1,874,000

On the NORTON SOUND HIGHLANDS this association occupies areas of low hills and broad intervening valleys. Elevations are less than 1,200 feet (360 m). Except in isolated spots, the soils are underlain by permafrost. Tundra vegetation covers most of the area, but a few forests of black spruce occupy low hills near the Koyuk River Valley. Valleys and foot slopes consist mainly of silty colluvial and alluvial sediment. The hills and ridges are dominantly very gravelly residual material. On a few ridges this material is shallow over bedrock. Landscape features associated with permafrost occur throughout the association. The various types of patterned ground include nets on broad ridgetops, stripes on hillsides, and polygons in broad nearly level valleys. Solifluction lobes are fairly common on some of the colluvial slopes.

Because of low summer temperatures and unsuitable soils, agriculture and commercial forestry are not feasible. Construction activities are severely limited because of steep slopes in the uplands and ice-rich permafrost in the valleys.

Principal components in the Norton Sound Highlands:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (40 percent) are poorly drained loams and silt loams with permafrost in valleys and on long foot slopes. The tundra vegetation is dominated by sedges, mosses, and low shrubs. Typically, these soils have a peaty surface mat over gray mottled silt loam. The permafrost table is generally less than 15 inches (40 cm) below the peaty surface mat. See *65b* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, (30 percent) are well drained very gravelly silt loams and sandy loams on the upper slopes of hills and ridges. The mean annual soil temperature is below freezing, but ice-rich permafrost, if any, is very deep. The vegetation is tundra dominated by low shrubs, forbs, grasses, lichens, and mosses. The soils commonly have a striped ground pattern consisting of parallel ridges and troughs in the direction of the slope. The ridges are about 4 to 8 feet (120 to 240 cm) wide and about 6 inches (15 cm) above the troughs, which are about 2 feet (60 cm) wide. Soils in the troughs generally support a higher proportion of shrubs and are stonier at the surface than soils on the ridges. Typically, under a thin peaty surface mat the soils consist of dark grayish brown very gravelly silt loam and sandy loam. See *20* in table 6.

Pergelic Ruptic-Histic Cryaquepts, very gravelly, nearly level to rolling, (10 percent) are poorly drained and somewhat poorly drained very gravelly loams with permafrost on benches and low rounded ridgetops. About 70 percent of the surface is covered by a thick mat of mosses, sedges, and low shrubs. The remaining surface area consists of roughly circular frost scars that are either barren or sparsely covered with tundra plants. Typically, both the soil under the thick peaty surface mat and the soil in the frost scars consist of gray mottled very gravelly loam or silt loam. Depth to the permafrost table ranges from a few inches under the thick moss mat up to 30 inches (75 cm) in the frost scars. See *79* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, (10 percent) are well drained, strongly acid, very gravelly soils on hills and ridges in close association with Pergelic Cryorthents. The vegetation is mainly grasses, lichens, and low shrubs and forbs. The mean annual soil temperature is below freezing, but ice-rich permafrost, if present, is very deep. Typically, under a thin mat of partially decomposed organic matter, the soils have a very dark grayish brown gravelly silt loam upper layer about 6 inches (15 cm) thick over olive or olive brown very gravelly silt loam. See *100* in table 6.

Other components (10 percent):

Pergelic Cryochrepts, very gravelly, hilly to steep, are well drained soils on high ridges. They lack a dark surface horizon but have a thin brown cambic horizon. See *93* in table 6.

Lithic Cryochrepts, very gravelly, hilly to steep, are well drained soils mostly on sharp ridgetops. They have a brown cambic horizon of very gravelly material that is less than 20 inches (50 cm) thick over bedrock. See *92a* in table 6.

Lithic Ruptic-Entic Cryumbrepts, very gravelly, hilly to steep, are well drained soils on high hills and ridges that have a very dark brown surface horizon over olive gray or olive brown stony material less than 20 inches (50 cm) thick over bedrock. There are many barren frost scars. See *98* in table 6.

Lithic Cryorthents, very gravelly, hilly to steep, are well drained gray soils on high ridges that are less than 20 inches (50 cm) thick over bedrock. See *16* in table 6.

Pergelic Cryofibrists, nearly level, are very poorly drained fibrous organic soils with a shallow permafrost table that occur in valley bottoms. The vegetation is dominated by sedges and mosses. See *28* in table 6.

In the INTERIOR ALASKA HIGHLANDS and BROOKS RANGE the association occupies terraces and moraines in broad glaciated valleys extending south from the Brooks Range. Elevations range from about 2,000 to 3,500 feet (600 to 1,050 m).

Most soils in valley bottoms are silty and have shallow permafrost. Organic soils occur in some of the lowest areas. Sedges and mosses make up most of the vegetation on these poorly drained soils. Soils of the hilly moraines are very gravelly, but those of lower moraines and parts of terraces are loamy. These soils are well drained and support a stunted spruce forest.

Because of short growing seasons, no agriculture except for carefully tended home gardens is feasible. Slow growth rates make forests unsuitable for commercial use. Roads, buildings, and other construction are possible on the well drained soils, but should be

avoided on poorly drained soils with ice-rich permafrost.

Principal components in the Interior Alaska Highlands and the Brooks Range:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (40 percent) are poorly drained loamy soils in depressions in moraines and terraces on the valley floors. The dominant vegetation is sedges, mosses, and low shrubs. Typically, the soils have a peaty surface layer over dark olive gray mottled silt loam. The permafrost table is generally less than 15 inches (40 cm) below the peaty surface layer. See *65a* and *65b* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, (25 percent) are well drained soils on moraines, alluvial fans, and side slopes of glaciated valleys. The vegetation includes stunted white spruce, dwarf birch, willows, low shrubs, mosses, and lichens. Typically, these soils have a thin black peaty organic mat and a thin layer of dark brown silt loam over very gravelly sandy loam or sand. Temperatures below depths of several feet are perennially below freezing, but ice-rich permafrost, if present, is very deep. See *20* in table 6.

Pergelic Cryofibrists, nearly level, (20 percent) are very poorly drained organic soils that consist mostly of fibrous sedge peat. They occur in small depressions in valley bottoms. The vegetation is dominantly sedges and low shrubs. The permafrost table is shallow. See *28* in table 6.

Pergelic Cryorthents, loamy, nearly level to rolling, (15 percent) are well drained loamy and sandy soils on low terraces and moraines in valleys. The vegetation is stunted white spruce, low shrubs, forbs, and lichens. Typically, these soils have an olive gray loamy layer over dark olive gray fine sandy loam. The permafrost table is deep. See *18* in table 6.

IQ6—Histic Pergelic Cryaquepts, loamy, nearly level to rolling-Pergelic Cryofibrists, nearly level association is in the following major land resource areas:

		Acres
172	Copper River Plateau	18,000
173	Alaska Range	18,000
174	Interior Alaska Lowlands	7,291,000
175	Kuskokwim Highlands	1,696,000
176	Interior Alaska Highlands	1,953,000
177	Norton Sound Highlands	1,627,000
178	Western Alaska Coastal Plains and Deltas	9,739,000
179	Bering Sea Islands	709,000
180	Brooks Range	188,000
181	Arctic Foothills	84,000
182	Arctic Coastal Plain	5,095,000
	Total	28,418,000

This association is widespread in Alaska, except in areas with no permafrost. It occupies broad valley bottoms, interior basins, deltas, and coastal plains. With few exceptions, the soils of the association are shallow over permafrost and are constantly wet.

On the COPPER RIVER PLATEAU, the ALASKA RANGE, the INTERIOR ALASKA LOWLANDS, the KUSKOKWIM HIGHLANDS, the INTERIOR ALASKA HIGHLANDS, and the BROOKS RANGE, the association occupies broad valleys of major rivers and large basins. Meandering sloughs, small rivers, and undrained depressions are common. Elevations range from sea level to about 3,000 feet (900 m) in high valleys in the southern part of the Brooks Range.

Most of the poorly drained loamy soils developed in nonacid or calcareous alluvium. Black spruce, shrubs, sedges, mosses, and lichens cover most nearly level to gentle slopes. Mosses, sedges, and scattered stunted black spruce occupy depressions. White spruce and cottonwood grow on the narrow levees bordering rivers.

These soils are too cold and wet for cultivation and commercial forestry. They have severe limitations for construction of roads, buildings, and other structures because of wetness and permafrost. Many areas provide excellent habitat for nesting waterfowl.

Principal components in the Copper River Plateau, the Alaska Range, the Interior Alaska Lowlands, the Kuskokwim Highlands, the Interior Alaska Highlands, and the Brooks Range:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (55 percent) are poorly drained soils on nearly level to moderate slopes in broad valleys and large basins. They support either a thick growth of sedge tussocks, mosses, and shrubs or a black spruce forest with a dense understory of shrubs, forbs, mosses, and lichens. The soils developed in nonacid alluvium. Below a thick mat of partly decomposed organic matter, the soils have a mottled gray silt loam horizon that is shallow over permafrost. In a few places on terraces and ground moraines they have a gravelly substratum. See *65a* and *65b* in table 6.

Pergelic Cryofibrists, nearly level, (40 percent) are poorly drained organic soils in broad depressions, in meander scars, and on the borders of shallow lakes. They support, for the most part, a dense cover of mosses, sedges, shrubs, and forbs. The soils consist of stratified layers of fibrous moss and sedge peat that is usually very strongly acid. The permafrost table is shallow. Some areas include low mounds covered with clumps of black spruce. Included with the fibrous peat are areas of partially decomposed sedge peat. See *28* in table 6.

Typic Cryofluvents, loamy, nearly level, (5 percent) are deep, well drained silty soils on nearly level natural levees bordering rivers. The dominant vegetation is a forest of white spruce, cottonwood, and willows, with grasses and horsetail in the understory. The soils consist of nonacid to calcareous stratified silty and fine sandy alluvium. In most places they are underlain by very gravelly sand. Permafrost is either deep or absent. See *7a, 7b, 7c,* and *7d* in table 6.

In the NORTON SOUND HIGHLANDS, the WESTERN ALASKA COASTAL PLAINS AND DELTAS, the BERING SEA ISLANDS, and the ARCTIC FOOTHILLS, the association occupies nearly level to rolling coastal plains and deltas bordering the Bering Sea (fig. 23) and large inland basins in generally hilly terrain. Maximum elevations within the association are about 200 feet (60 m). Mineral soils formed mostly in stratified silty and sandy alluvial deposits, but in many places layers of volcanic ash and loess have also been deposited. A few areas are underlain by glacial drift. Organic soils occupy many shallow depressions, along with many small lakes and meandering streams. Thick permafrost underlies the entire area. The dominant vegetation is sedge tussocks

Figure 23.—**Loamy Histic Pergelic Cryaquepts and Pergelic Cryofibrist in Yukon-Kuskokwim Delta. Complex pattern of shifting watercourses, thaw lakes and drained lakes, and slightly elevated irregular "islands" is characteristic.**

and low shrubs, forbs, and moss. A few patches of stunted trees grow on narrow levees bordering rivers and streams.

These soils are too cold and wet for agriculture and forestry. They have severe limitations for most types of construction. Many migratory water birds use the areas for summer nesting. The vegetation also provides habitat for caribou and some small mammals. Several reindeer herds include these areas in their range.

Principal components in the Norton Sound Highlands, the Western Alaska Coastal Plains and Deltas, the Bering Sea Islands, and the Arctic Foothills:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (55 percent) are poorly drained soils in nearly level to rolling coastal plains, deltas, and inland basins. They support a thick cover of sedge tussocks, low shrubs, forbs, mosses, and lichens. Mostly they formed in nonacid silty and sandy alluvium.

Typically, under a thick mat of partly decomposed organic matter, the soils have a layer of mottled gray silt loam with permafrost at shallow depth. In some places the permafrost is in sandy or gravelly material. Water is perched above the permafrost in the summer. See *65b* in table 6.

Pergelic Cryofibrists, nearly level, (40 percent) are very poorly drained peat soils in broad depressions, lake borders, and shallow drainageways. They support a dense vegetation that includes mosses, sedges, low shrubs, and forbs. The soils consist of layered fibrous moss and sedge peat that is usually very strongly acid. In places a few thin lenses of volcanic ash occur in the upper .2 feet (60 cm) of the peat. Small areas of partially decomposed peat are included. These soils are

always wet, and permafrost is normally close to the surface. Ice-core mounds, or pingos, occur in some areas. Areas subject to inundation by high tides or spring flooding contain thin layers of silty material. See *28* in table 6.

Other components (5 percent) :

Pergelic Cryaquepts, loamy, nearly level to rolling, are poorly drained soils in beds of naturally drained thaw lakes and the narrow drainageways connecting lakes and ponds. They formed in stratified silty and sandy lacustrine deposits or in alluvial sediment. The permafrost table is at 16 to 30 inches (40 to 75 cm). Vegetation includes willows, grasses, sedges, horsetail, and other tundra plants. See *72b* in table 6.

Pergelic Sideric Cryaquods, loamy, nearly level to rolling, are somewhat poorly drained soils at the edges of slopes bordering lakes and drainageways. They have thin albic and spodic horizons and a mottled stratified substratum. The vegetation includes mosses, sedges, and low shrubs. See *110* in table 6.

This association also occurs on the nearly level to rolling ARCTIC COASTAL PLAIN bordering the Arctic Ocean. Elevations range from sea level to about 400 feet (120 m). This treeless area is characterized by many small thaw lakes, many of them elongated in a north-northwesterly direction perpendicular to the prevailing winds (fig. 24). As much as 40 to 50 percent of the surface area is water. Low terraces, broad shallow depressions, and flood plains are typical of the landscape. Frost features, including polygons, hummocks, frost boils, and pingos, are common. Thick permafrost underlies the entire area. The dominant poorly drained soils have developed principally in deep loamy sediment under a thick cover of sedge tussocks, low shrubs,

***Figure 24.*—Histic Cryaquepts in loamy sediment and Pergelic Cryofibrists in depressions on Arctic Coastal Plain. Polygonal surface pattern and elongated thaw lakes are characteristic features of the Coastal Plain.**

forbs, mosses, and lichens. Very poorly drained fibrous peat soils occupy broad depressions, shallow drainageways, and lake borders, commonly under a thick cover of sedges. Soils of this association are too cold and wet for cultivation and most of them have very severe limitations as sites for most types of construction. Caribou and a few moose, wolves, and small furbearers use this area. It is a major nesting ground for migratory birds.

Principal components in the Arctic Coastal Plain:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (50 percent) are poorly drained soils on nearly level to rolling plains. Polygons, frost scars, low mounds, and pingos are common surface features. The vegetative cover includes sedge tussocks, grasses, low shrubs, forbs, mosses, and lichens. Typically, under a thick mat of partly decomposed organic matter, the soils have a mottled dark gray layer of nonacid silt loam or loam over gray loamy material. The permafrost table is shallow. See *65b* in table 6.

Pergelic Cryofibrists, nearly level, (20 percent) are very poorly drained organic soils in broad depressions and shallow drainageways and on the borders of lakes. They consist of fibrous sedge and moss peat. In places, especially near the coast, the sedge peat contains lenses of sandy material. The peat is normally very strongly acid. Permafrost is shallow, and in summer the soil is always wet. See *28* in table 6.

Pergelic Cryaquepts, loamy, nearly level to rolling, (15 percent) are poorly drained soils on higher parts of the plain, especially in the northernmost sections, and in the beds of naturally drained thaw lakes. They support low shrubs, forbs, mosses, lichens, and some sedge tussocks. Typically, under a thin mat of organic matter, they have a thin layer of mottled dark grayish brown silt loam or loam over mottled gray loamy material. Permafrost is shallow. The reaction is normally nonacid. See *72b* in table 6.

Pergelic Cryaquolls, loamy, nearly level to rolling, (5 percent) are somewhat poorly drained soils on gentle slopes under a cover of low shrubs, sedges, grasses, and lichens. They formed normally in calcareous material. Typically, under a surface mat of organic material, the soils have an upper layer of black mucky silt loam over mottled very dark grayish brown silt loam and, below that, mottled very dark gray loamy material. The underlying material is gravelly in places. The permafrost table is shallow. See *101* in table 6.

Other components (10 percent):

Pergelic Cryorthents, very gravelly, hilly to steep, are well drained gray soils on included knolls and escarpment edges. They have a sparse cover of low shrubs, grasses, forbs, and lichens. See *20* in table 6.

Pergelic Ruptic-Histic Cryaquepts, loamy, nearly level to rolling, are poorly drained silty clay loams on low hills scarred by frost. They have a broken cover of low shrubs, forbs, sedges, mosses, and lichens. See *78* in table 6.

Pergelic Cryopsamments, sandy, nearly level to rolling, are well drained sandy soils on low stabilized dunes. The permafrost table is moderately deep. Vegetation includes grasses, lichens, low shrubs, and forbs. See *23* in table 6.

Pergelic Cryaquepts, sandy, nearly level to rolling, are poorly drained sandy soils with a shallow permafrost table in swales between dunes. Vegetation is dominated by sedges, mosses, and low shrubs. See *74* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, are well drained soils with dark surface horizons on low knolls and escarpment edges. They support a sparse cover of low shrubs, grasses, forbs, and lichens. See *100* in table 6.

IQ7—Histic Pergelic Cryaquepts, loamy, nearly level to rolling-Pergelic Cryaquepts, very gravelly, nearly level to rolling association is in the following major land resource areas:

	Acres
176 Interior Alaska Highlands	257,000
177 Norton Sound Highlands	4,670,000
178 Western Alaska Coastal Plains and Deltas	105,000
181 Arctic Foothills	902,000
Total	5,934,000

This association occupies broad valleys, piedmont plains, uplifted coastal plains, and foot slopes of low hills on the Seward Peninsula and adjoining areas in northwestern Alaska. Elevations range from near sea level in the coastal areas to about 1,000 feet (300 m) in broad upland valleys.

The dominant soils are poorly drained and shallow over permafrost. They consist of very gravelly material covered in many places with silty sediment. The surface is commonly patterned with solifluction lobes on sloping areas, frost scars on low knolls, and polygons in some of the nearly level valley bottoms. The vegetation is typically tundra dominated by sedges, mosses, lichens, and low shrubs. On some windswept gravelly areas near the coast the vegetation is very sparse.

The principal soils have severe limitations for intensive use and development and are not potentially suitable for cultivation. Primarily they provide wildlife habitat for species that frequent tundra areas. They are suitable for reindeer grazing.

Principal components:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (30 percent) are poorly drained soils with a shallow permafrost table in broad valley bottoms and on the lower parts of long foot slopes. Some areas have a polygonal surface pattern. The soils formed in moderately deep loamy sediment underlain by very gravelly and stony material. The vegetation is mainly sedge tussocks, mosses, and low shrubs. Beneath a thick peaty surface mat, the soils have a mottled dark gray silt loam to gravelly loam horizon that commonly contains black streaks of frost-churned organic matter. Depth to permafrost ranges from about 6 to 12 inches (15 to 30 cm) below the mineral surface. See *65a* and *65b* in table 6.

Pergelic Cryaquepts, very gravelly, nearly level to rolling, (30 percent) are poorly drained soils with permafrost that occupy stream terraces and windswept foot slopes on piedmont plains near the coast. They formed in very gravelly alluvial material and support tundra vegetation consisting mainly of sedges, mosses, and low shrubs. Beneath a thin peaty surface mat or sparse vegetation, the soils consist of mottled dark

gray very gravelly loam or silt loam that commonly contains many stones. Depth to perennially frozen material ranges from about 15 to 30 inches (40 to 75 cm). See *75* in table 6.

Pergelic Ruptic-Histic Cryaquepts, very gravelly, nearly level to rolling, (15 percent) are poorly drained frost-rived soils on low knolls and long slopes. In these areas a thick vegetative mat that covers about 60 to 70 percent of the soil surface is interrupted by closely spaced, sparsely vegetated frost scars. The vegetation is mainly mosses, sedges, and low shrubs. Both the soil under the thick mat of vegetation and the soil in the frost scars have mottled dark gray very gravelly loam horizons that extend into perennially frozen material. Depth to permafrost is usually less than 10 inches (25 cm) under the thick peaty vegetative mat and ranges from about 15 to 30 inches (40 to 75 cm) in the frost scars. See *79* in table 6.

Pergelic Cryorthents, very gravelly, nearly level to rolling, (15 percent) are well drained soils on the tops of knolls and on parts of low terraces near short escarpments. The vegetation is arctic tundra, consisting mainly of grasses, lichens, mosses, dryas, and dwarf shrubs. On windswept soils near the coast, generally in areas of limestone outcrops, and on sharp knolls the vegetation is usually very sparse and much of the surface is barren. The soils consist of dark grayish brown or olive brown very gravelly sandy loam. Although they have a mean annual soil temperature below freezing, they do not retain enough moisture for ice-rich permafrost to form. See *19* in table 6.

Other components (10 percent):

Pergelic Cryoborolls, very gravelly, nearly level to rolling, are well drained soils formed in nonacid and calcareous gravelly material on foot slopes and plains near hills of basalt or limestone bedrock. They have a dark, nonacid mineral surface layer and are moderately deep to permafrost. The vegetation is sparse tundra dominated by low shrubs and forbs. See *106* in table 6.

Pergelic Cryaquolls, very gravelly, nearly level to rolling, are poorly drained, nonacid to calcareous soils in valleys and on low foot slopes in close association with Pergelic Cryoborolls. The soils have a dark surface layer enriched with organic matter. Permafrost is shallow. The vegetation is tundra dominated by sedges. See *102* in table 6.

Pergelic Cryochrepts, very gravelly, hilly to steep, are well drained soils on low hills and short escarpments. The vegetation is sparse tundra dominated by low shrubs and forbs. See *93* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, are well drained soils on a few low hills. They have a dark, acid mineral surface layer. The vegetation is sparse tundra dominated by low shrubs and forbs. See *100* in table 6.

Pergelic Cryopsamments, sandy, hilly to steep, are well drained soils on low dunes near the coast. The vegetation is grasses, willows, and forbs. See *24* in table 6.

IQ8—Histic Pergelic Cryaquepts, loamy, nearly level to rolling-Pergelic Cryaquepts, very gravelly, hilly to steep association is in the following major land resource areas:

		Acres
174	Interior Alaska Lowlands	36,000
175	Kuskokwim Highlands	895,000
176	Interior Alaska Highlands	1,033,000
177	Norton Sound Highlands	827,000
181	Arctic Foothills	3,980,000
	Total	6,771,000

This association is widespread in interior, western, and arctic Alaska. The dominant soils in all areas have similar characteristics, but there are important differences among the soils of relatively minor extent.

On the INTERIOR ALASKA LOWLANDS, KUSKOKWIM HIGHLANDS, and INTERIOR ALASKA HIGHLANDS the association occupies nonglaciated mature dissected hills and broad intervening valleys. Elevations range from about 700 feet (210 m) in the lower valleys to almost 2,500 feet (760 m) on a few high hills.

On ridges and hills, most of the soils consist of very gravelly material weathered from the local rock. The soils in valleys and on low foot slopes generally formed in loamy colluvium. The dominant soils are underlain by permafrost, but in some of the well drained soils on south-facing slopes permafrost is deep or absent. The vegetation is of several general types. Poorly drained soils in valleys and on foot slopes support tundra and scattered black spruce forests. The tundra on these soils is mainly sedge tussocks, mosses, willows, dwarf birch, and other low shrubs. Well drained soils on the lower parts of south-facing slopes are commonly forested with white spruce, paper birch, and aspen. On soils above tree line, the vegetation is tundra dominated by mosses, grasses, sedges, and shrubs. The dominant soils in the association have severe limitations for intensive use and development and are not potentially suitable for commercial forestry or cultivation. Primarily, they provide wildlife habitat for many species.

Principal components in the Interior Alaska Lowlands, the Kuskokwim Highlands, and the Interior Alaska Highlands:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (30 percent) are poorly drained soils with a shallow permafrost table in valleys and on foot slopes. They support sedges, tussocks, mosses, willows, shrubs, and scattered forests of black spruce. Typically, the soils have a thick peaty surface mat and a mottled, dark gray silt loam or gravelly silt loam horizon with black streaks of frost-churned organic matter. Depth to ice-rich permafrost is usually 10 to 20 inches (25 to 50 cm) below the organic mat. See *65a* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, (25 percent) are poorly drained soils with permafrost on hills and ridges above tree line. The vegetation is dominantly mosses, sedges, and low shrubs. Beneath a thin peaty surface mat, the soils have a mottled dark gray very gravelly and stony loam horizon that extends into perennially frozen material at a depth of 20 to 30 inches (50 to 75 cm). See *76* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (25 percent) are poorly drained soils with a high permafrost table on north-facing slopes. The vegetation is mosses, sedges, willows, low shrubs, and a few black spruce. The soils have a thick peaty surface mat over mottled, dark gray, very gravelly and stony loam or silt loam derived from underlying rock. Depth to perma-

frost is generally less than 20 inches (50 cm). See *69* in table 6.

Typic Cryochrepts, very gravelly, hilly to steep, (10 percent) are well drained soils without permafrost on south-facing slopes below tree line. They formed in shallow to moderately deep very gravelly material over weathered rock. The vegetation is a forest of paper birch, white spruce, and quaking aspen. Beneath a thin mat of forest litter, the soils have a brown gravelly or very gravelly silt loam horizon about 10 to 18 inches (25 to 45 cm) thick that grades with depth to very gravelly olive or olive brown silt loam underlain by weathered bedrock. See *86* in table 6.

Other components (10 percent):

Pergelic Cryofibrists, nearly level, are very poorly drained organic soils with a high permafrost table. They occupy parts of valley bottoms. See *28* in table 6.

Lithic Cryorthents, very gravelly, hilly to steep, are well drained gray soils on sharp ridgetops above tree line. They are shallow over bedrock. The vegetation is sparse tundra dominated by low shrubs and forbs. See *16* in table 6.

Pergelic Cryochrepts, very gravelly, hilly to steep, are well drained soils with thin brown cambic horizons. They occupy slopes above tree line. The vegetation is alpine shrubs, grasses, and forbs. See *93* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, are well drained soils on slopes above tree line. The soils have a thin albic horizon over a reddish brown spodic horizon about 10 inches (25 cm) thick. The vegetation is alpine shrubs, grasses, and forbs. See *137* in table 6.

In the NORTON SOUND HIGHLANDS and ARCTIC FOOTHILLS the association occupies extensive parts of the foothills north of the Brooks Range (fig. 25) and a relatively small isolated plateau in the northern part of the Seward Peninsula. Broad sloping valleys separated by steep ridges, hills, and knolls dominate the landscape. Elevations range from near sea level on a few foot slopes bordering the northwest coast to about 3,000 feet (900 m) on hills and ridges near the Brooks Range. All areas are underlain by permafrost. The dominant soils in valleys and on long foot slopes formed in loamy colluvial sediment. On hills and ridges most of the soils consist of very gravelly material weathered from sedimentary rock. A few soils near the Brooks Range formed in very gravelly glacial drift. In the northern Seward Peninsula they developed in ashy material over weathered lava. The vegetation is tundra made up of mosses, sedges, lichens, grasses, dwarf shrubs, and small forbs. Long slopes commonly have a striped vegetative pattern, and many frost-scarred areas occur on hills and ridges. A few windswept peaks are nearly bare. The soils have severe limitations for intensive use and development and are not potentially suitable for cultivation. The vegetation is used by caribou and other wildlife and is suitable for reindeer grazing.

Principal components in the Norton Sound Highlands and the Arctic Foothills:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (45 percent) are poorly drained soils that occupy broad sloping valleys and the lower parts of foot slopes. They formed in loamy colluvial sediment and are shallow over ice-rich permafrost. The vegetation is mainly sedge tussocks, mosses, and low shrubs. Beneath a thick peaty surface mat, the soils consist of mottled gray silt loam to light silty clay loam that contains black streaks of frost-churned organic matter. Depth to permafrost is about 6 to 12 inches (15 to 30 cm) below the organic surface mat. The perennially frozen material commonly contains thick lenses of clear ice. See *65b* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, (20 percent) are poorly drained soils on the slopes of hills and ridges. They formed in very gravelly and stony residual and colluvial material weathered mainly from sedimentary bedrock. The vegetation is mainly mosses, sedges, lichens, and dwarf shrubs. Some areas are frost scarred and nearly bare. The soils generally have a thin peaty surface mat over mottled dark gray very gravelly and stony loam or silt loam. Depth to permafrost ranges from about 10 to 30 inches (25 to 75 cm). See *76* in table 6.

Pergelic Ruptic-Histic Cryaquepts, very gravelly, nearly level to rolling, (15 percent) are poorly drained frost-scarred soils on broad rounded ridgetops and knolls. They formed in very gravelly and stony material weathered from local rock. The vegetation, which consists mainly of mosses, sedges, and low shrubs, is interrupted by closely spaced, sparsely vegetated frost scars that occupy about 30 to 40 percent of the surface. The soil between the frost scars has a thick peaty surface mat over mottled dark gray very gravelly and stony loam that is perennially frozen below a depth of 6 to 12 inches (15 to 30 cm). The soil in the frost scars has no peaty surface mat and is deeper over permafrost. It is similar in other characteristics. See *79* in table 6.

Pergelic Cryoborolls, very gravelly, hilly to steep, (10 percent) are well drained soils on hills and ridges near the Brooks Range. They commonly formed in very gravelly glacial drift or colluvial material in areas near limestone rock or calcareous shale. The vegetation is dominated by mosses, grasses, lichens, dryas, and low shrubs. Beneath a surface mat of moss and partially decomposed organic matter, the soils have 6 to 12 inches (15 to 30 cm) of black to very dark grayish brown very gravelly silt loam that is enriched with organic matter and is nonacid to calcareous. The subsoil and substratum generally consist of olive gray, calcareous very gravelly and stony silt loam or loam. Depth to permafrost ranges from about 15 to 30 inches (45 to 75 cm). The perennially frozen material seldom contains thick lenses of ice. See *107* in table 6.

Other components (10 percent):

Pergelic Cryofibrists, nearly level, are very poorly drained soils of perennially frozen peat in scattered depressions in valley bottoms. The vegetation is dominantly sedges and mosses. See *28* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, are well drained gray soils on the tops of broad hills and ridges. The vegetation is mainly grasses, lichens, dwarf shrubs, and forbs. The soils commonly have many bare frost scars. See *20* in table 6.

Lithic Cryorthents, very gravelly, hilly to steep,

Figure 25.—Loamy Histic Pergelic Cryaquepts on lower slopes, very gravelly Pergelic Cryaquepts on higher and steeper slopes, and Pergelic Ruptic-Histic Cryaquepts on rounded ridgetops. Striped vegetative pattern is common. Arctic Foothills north of Anaktuvuk Pass.

occur on sharp, narrow ridgetops and peaks. They are well drained and shallow over bedrock. The vegetation is a sparse cover of grasses, lichens, low shrubs, and forbs. See *16* in table 6.

Rubble land consists of very sparsely vegetated and barren areas of gravel and stones on windswept peaks and ridgetops. See *146* in table 6.

Pergelic Cryaquolls, loamy, nearly level to rolling, are poorly drained, nonacid or calcareous soils darkened by organic matter. They occur in swales and valleys near the Brooks Range and support a vegetation dominated by sedges and mosses. See *101* in table 6.

IQ9—Histic Pergelic Cryaquepts-Typic Cryochrepts, loamy, nearly level to rolling association is in the following major land resource areas:

	Acres
174 Interior Alaska Lowlands	457,000
175 Kuskokwim Highlands	1,653,000
176 Interior Alaska Highlands	2,675,000
Total	4,785,000

This association occupies broad terraces and gently rolling hills bordering the Tanana, Porcupine, Little Black, Black, and Yukon Rivers. The broad undulating terraces are at an elevation of about 300 feet (90 m) and are dotted with a number of small lakes bordered by muskegs. The hills, at elevations ranging from about 400 to 1,500 feet (120 to 450 m), have gentle to moderate slopes interrupted by drainageways and streams. Silty loess covers most of the area except for a few peaks where gravelly material weathered from bedrock is exposed. Some depressions are filled with

fibrous peat. Permafrost underlies all low parts of the area and occurs in places at depths below 5 feet (150 cm) in the uplands of the Interior Alaska Highlands.

The vegetation on the long lower slopes and drainageways is dominantly black spruce, sedge tussocks, and moss. White spruce, aspen, grass, and brush cover the upper slopes. Where they have been severely burned, however, they support only willows, grasses, forbs, and young aspen.

Most poorly drained soils in the association are unsuitable for cultivation, forestry, or construction. Well drained forested soils on terraces and hills at elevations below 1,000 feet (300 m) can be used for agriculture. All well drained soils are suitable for buildings, roads, and other structures.

Principal components:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (50 percent) are poorly drained silty soils that occupy broad depressions and drainageways, terraces, long concave toe slopes of hills, and, in places, north-facing upper hillsides. The vegetation includes black spruce, sedge tussocks, mosses, low shrubs and forbs, and lichens. The soils formed mostly in deep silty nonacid loess, but at higher elevations they are acid and contain stones and pebbles. Typically, they have a thick mat of partly decomposed black organic matter over nonacid, mottled olive gray silt loam with permafrost at a depth of about 18 inches (45 cm) below the mineral surface. See *65a* in table 6.

Typic Cryochrepts, loamy, nearly level to rolling, (30 percent) are deep, well drained silty soils on parts of terraces, stabilized dunes, and low hills. They support a forest of white spruce, paper birch, and aspen or, in burned-over areas, of young aspen, willows, grasses, and forbs. The soils developed in nonacid silty loess with moderate amounts of mica. Typically, under a thin mat of forest litter, they have a thin dark surface horizon over a brown silt loam horizon about 10 inches (25 cm) thick. The loess is underlain by sandy or stratified material at depths greater than 40 inches (100 cm). See *81b* in table 6.

Aeric Cryaquepts, loamy, nearly level to rolling, (10 percent) are moderately well drained to somewhat poorly drained soils in very shallow depressions in terraces and on long, slightly concave slopes on hillsides. The vegetation is either a white spruce-paper birch or a black spruce forest. Recently burned areas are covered by alder, willows, shrubs, grasses, and fireweed. Typically, they have a thin, black organic horizon over a thin, dark silt loam mineral layer and, below that, olive brown gravelly silt loam. The soils are nonacid. Permafrost occurs sporadically at depths below 5 feet (150 cm). See *58* in table 6.

Other components (10 percent):

Pergelic Cryaquepts, loamy, nearly level to rolling, are somewhat poorly drained soils in depressions under a cover of shrubs, grasses, fireweed, and other forbs. They are associated with Histic Pergelic Cryaquepts. See *72a* in table 6.

Pergelic Cryofibrists, nearly level, are fibrous organic soils that consist of very strongly acid sphagnum and sedge peat with shallow permafrost. They occupy valley bottoms, areas bordering lakes, and depressions in terraces. The vegetation is a dense cover of sphagnum moss, sedges, shrubs, and forbs. Small areas of soils made up of partially decomposed peat are included. See *28* in table 6.

Typic Cryorthents, loamy, nearly level to rolling, are deep, well drained, gray soils that consist of stratified silty and sandy material. They occupy terraces and low hills. The vegetation is dominantly young aspen, shrubs, forbs, and grasses. See *10a* in table 6.

IQ10—Histic Pergelic Cryaquepts, loamy, nearly level to rolling-Typic Cryumbrepts, very gravelly, hilly to steep association is in the following major land resource area:

	Acres
177 Norton Sound Highlands	1,046,000

This association occupies an area of broad sloping valleys and low hills between the lower Yukon River and Norton Sound. Elevations range from about 300 feet (90 m) in the valley bottoms to 1,000 feet (300 m) on the hills.

In valleys and on long foot slopes, most of the soils formed in silty colluvium. They are poorly drained and are shallow over permafrost. The vegetation on these soils is mainly sedges, mosses, willows, dwarf birch, other low shrubs, and scattered forests of black spruce. Most of the soils on low hills and south-facing slopes are well drained, are very gravelly, and have no permafrost. They support sparse, scattered forests of stunted white spruce, paper birch, alder, willows, and dwarf birch.

The dominant soils have severe limitations for most types of intensive use or development and are not suitable for cultivation or commercial forestry. Primarily, they provide habitat for wildlife, including caribou and a few moose. Much of the tundra vegetation is suitable for reindeer grazing.

Principal components:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (50 percent) are poorly drained soils with permafrost in valleys and on the lower parts of long foot slopes. The vegetation is mainly sedges, mosses, willows, low shrubs, and scattered forests of black spruce. The soils have a thick peaty surface mat over mottled, frost-churned, dark gray silt loam. Depth to permafrost is about 15 to 30 inches (40 to 75 cm). See *65b* in table 6.

Typic Cryumbrepts, very gravelly, hilly to steep, (25 percent) are well drained soils on the slopes of hills and ridges. They support sparse stands of stunted white spruce and paper birch, but the dominant vegetation is grasses, alder, willows, and dwarf birch. At the surface the soil has 10 to 15 inches (25 to 40 cm) of acid, very dark brown gravelly silt loam. This layer overlies olive brown to dark grayish brown very gravelly and stony silt loam. Permafrost is deep or absent. See *94* in table 6.

Typic Cryochrepts, very gravelly, hilly to steep, (15 percent) are well drained soils on south-facing slopes of some hills and ridges. The vegetation is a sparse forest of stunted white spruce and paper birch and an understory of dwarf birch, low shrubs, mosses, and lichens. Beneath a thin surface mat of organic matter

the soil is brown very gravelly loam or silt loam grading with depth to olive brown very gravelly and stony silt loam. Permafrost is deep or absent. See *86* in table 6.

Pergelic Cryaquepts, very gravelly, nearly level to rolling, (10 percent) are poorly drained soils with permafrost on the tops of rounded hills and ridges above tree line. The vegetation is tundra dominated by sedges, mosses, and low shrubs. Beneath a thin surface mat of organic matter the soils consist of mottled dark gray very gravelly and stony loam or silt loam. Depth to permafrost is about 20 to 30 inches (50 to 75 cm). See *75* in table 6.

IQ11—Histic Pergelic Cryaquepts, loamy, nearly level to rolling-Pergelic Cryumbrepts, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
175 Kuskokwim Highlands	511,000
177 Norton Sound Highlands	1,033,000
181 Arctic Foothills	442,000
Total	1,986,000

This association occupies maturely dissected uplands separated by broad sloping valleys in several areas of western Alaska. Elevations range from sea level in a few places that border the coast of Norton Sound, to about 1,500 feet (450 m) on hills and ridges. All of the areas have continuous permafrost. The vegetation is mostly tundra, but a few small stands of stunted white spruce occupy several valleys that are protected from strong winds. A few black spruce grow on low foot slopes. Solifluction lobes are common on long slopes, and a few frost-scarred areas occur on ridges.

The dominant soils in valleys and on foot slopes formed in thick deposits of loamy colluvium, but a few of the soils on river terraces consist of very gravelly alluvial material. On ridges and hills most of the soils formed in very gravelly residual material over weathered bedrock. The dominant soils have severe limitations for most types of intensive use or development. They are not suitable for cultivation, but the natural vegetation in some areas is suitable for reindeer grazing. Primarily, the soils provide habitat for wildlife species that frequent the tundra.

Principal components:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (30 percent) are poorly drained soils with a shallow permafrost table that occupy broad valleys and long foot slopes. They formed in thick deposits of loamy colluvial sediment. The dominant vegetation is sedges, mosses, low shrubs, and, in a few places, stunted black spruce. Beneath a thick peaty surface mat, the soils consist of mottled, dark gray silt loam that contains black streaks of frost-churned organic matter. Depth to ice-rich perennially frozen material is about 10 to 20 inches (25 to 50 cm). See *65a* and *65b* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, (25 percent) are well drained soils with permafrost on rounded hills and ridges. They formed in very gravelly and stony residual material that is moderately deep over weathered bedrock. The vegetation is tundra made up of grasses, patches of alder and willow brush, mosses, lichens, dwarf birch, and other shrubs and forbs. Beneath a thin mat of organic matter, the soils have a very dark grayish brown to dark brown very gravelly silt loam layer that is about 8 to 16 inches (20 to 40 cm) thick and is acid in reaction. The subsoil and substratum generally consist of olive gray very gravelly and stony silt loam or loam. Although the soils have a mean annual temperature below freezing, the very gravelly material seldom retains enough moisture in the upper 40 inches (1 m) to form ice-rich permafrost. See *100* in table 6.

Pergelic Ruptic-Histic Cryaquepts, loamy, nearly level to rolling, (15 percent) are poorly drained soils with permafrost on low knolls and foot slopes. They formed in silt loam or gravelly silt loam material. The vegetation is mainly mosses, sedges, and low shrubs. There are many closely spaced, nearly barren frost scars. Between the frost scars, the soils have a thick peaty surface mat over mottled dark gray frost-churned gravelly silt loam or silt loam that is perennially frozen below depths of 10 to 20 inches (25 to 50 cm). In the frost scars, the soils have no organic mat and are deeper over permafrost. In other characteristics they are similar. See *78* in table 6.

Pergelic Cryaquepts, very gravelly, nearly level, (10 percent) are poorly drained soils with permafrost on stream terraces. They formed in very gravelly alluvial sediment. The vegetation is mainly sedges, mosses, willows, and low shrubs. Typically, the soils have a thin peaty surface mat over very gravelly silt loam or sandy loam that is perennially frozen below a depth of 20 to 40 inches (50 to 100 cm). See *75* in table 6.

Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling, (10 percent) are poorly drained soils with shallow permafrost that occur on short foot slopes. They formed in very gravelly and stony colluvial material and support a thick vegetative cover of mosses, sedges, willows, dwarf birch, and low shrubs. The soils have a thick peaty surface mat over mottled, dark gray very gravelly and stony silt loam that is perennially frozen below 10 to 20 inches (25 to 50 cm). See *68* in table 6.

Other components (10 percent):

Pergelic Cryorthents, very gravelly, hilly to steep, are well drained soils on a few hilltops. They support a sparse vegetative cover of grasses, low shrubs, lichens, mosses, and forbs. See *20* in table 6.

Pergelic Cryochrepts, very gravelly, hilly to steep, are well drained soils on a few slopes near the crests of hills and ridges. They have a brown cambic horizon developed in very gravelly material over weathered bedrock. The vegetation is mainly grasses, shrubs, and forbs. See *93* in table 6.

Pergelic Cryoborolls, very gravelly, hilly to steep, are well drained soils on a few hills underlain by basaltic rock. They have a dark, nonacid to calcareous upper horizon rich in organic matter. The vegetation is mainly grasses, shrubs, and forbs. See *107* in table 6.

Pergelic Cryaquolls, loamy, nearly level to rolling, are poorly drained soils on lower foot slopes of basaltic hills. They have dark, nonacid upper layers rich in organic matter and are shallow over permafrost. The vegetation includes sedges, mosses, and low shrubs. See *101* in table 6.

Pergelic Cryofibrists are very poorly drained, fibrous

organic soils in valley bottoms and depressions. They are shallow over permafrost. See *28* in table 6.

IQ12—Histic Pergelic Cryaquepts-Typic Cryorthods, loamy, nearly level to rolling association is in the following major land resource areas:

	Acres
174 Interior Alaska Lowlands	62,000
175 Kuskokwim Highlands	772,000
177 Norton Sound Highlands	69,000
Total	903,000

On the INTERIOR ALASKA LOWLANDS and KUSKOKWIM HIGHLANDS this association is on broad nearly level terraces interspersed with low hills and flood plains. In places the terraces and flood plains are dotted with lakes and muskegs. Elevations range from about 300 feet (90 m) near the rivers to 900 feet (275 m) on a few hilltops.

Most of the hills and higher terraces are mantled with thick deposits of loess, but low terraces and flood plains consist mainly of loamy alluvial sediment of variable thickness over very gravelly material. On long foot slopes and nearly level low areas on terraces the dominant soils are poorly drained and are underlain with permafrost. Many of these soils are under a forest of stunted black spruce, but some support a cover of sedge tussocks, mosses, willows, dwarf birch, and low shrubs. Well drained soils without permafrost occupy rolling hills, terraces, and natural levees on the flood plains. On the hills and terraces these soils have mixed stands of white spruce, paper birch, and quaking aspen. On the natural levees stands of cottonwood are common.

Soils of the association provide habitat for a wide variety of wildlife species. Although the dominant soils have severe limitations for intensive uses, largely because of permafrost and wetness, most of the forested, well drained soils are potentially suitable for agricultural crops and forestry. These soils also have the fewest limitations for buildings, roads, and other construction.

Principal components in the Interior Alaska Lowlands and the Kuskokwim Highlands:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (45 percent) are poorly drained soils with permafrost that occupy foot slopes on low hills and nearly level slight depressions on terraces. The dominant vegetation is a forest of black spruce, but many areas have a cover of sedge tussocks, mosses, willows, dwarf birch, and low shrubs. Beneath a thick peaty surface mat, the soils consist of mottled dark gray silt loam that is perennially frozen below a depth of 10 to 25 inches (25 to 60 cm). The soils commonly contain dark frost-churned streaks and, directly above the permafrost, a thin layer darkened by organic matter. The perennially frozen soil contains thick lenses of clear ice. See *65a* in table 6.

Typic Cryorthods, loamy, nearly level to rolling, (25 percent) are well drained soils without permafrost that occupy nearly level terraces and low rolling hills. They formed in a thick mantle of silty loess over sandy and very gravelly material on the terraces and over weathered bedrock on the hills. The vegetation is a forest of white spruce, paper birch, and aspen. Under a mat of forest litter about 2 to 5 inches (5 to 12 cm) thick, the soils have a thin gray albic horizon and a dark reddish brown to brown spodic horizon about 10 to 18 inches (25 to 45 cm) thick. The material below the spodic horizon is olive to olive brown silt loam. Depth to very gravelly material or weathered bedrock ranges from about 30 to 50 inches (75 to 125 cm). See *120* in table 6.

Pergelic Cryofibrists, nearly level, (15 percent) are very poorly drained organic soils with permafrost in nearly level muskegs on terraces and flood plains. The vegetation is mainly sedges, mosses, and low shrubs. Beneath a mat of live moss and sedge, the peat consists mainly of dark brown, relatively undecomposed sedge and moss fibers. Depth to ice-rich permafrost is about 15 to 25 inches (40 to 60 cm). During the summer, water perched above the permafrost keeps the peat wet and spongy. See *28* in table 6.

Typic Cryofluvents, loamy, nearly level, (10 percent) are well drained soils on flood plains. They commonly occupy narrow natural levees and stream terraces that are slightly above the general level of the flood plains. Permafrost is deep or absent. The vegetation is a forest of cottonwood, white spruce, and paper birch. Some of these soils are susceptible to occasional flooding for short periods. Others are rarely flooded. Beneath 2 to 4 inches (5 to 10 cm) of forest litter, the soils consist of dark gray stratified silt and fine sand that contains pockets and discontinuous layers of buried organic material. The stratified material generally is 30 to 50 inches (75 to 125 cm) thick over gravel and sand, but in places it is much thicker. The water table is normally deeper than 4 feet (120 cm). See *7a* in table 6.

Other components (5 percent):

Histic Pergelic Cryaquepts, loamy, hilly to steep, occupy north-facing slopes. They are poorly drained and consist of thick silty colluvial sediment. Ice-rich perennially frozen material occurs at a depth of 10 to 20 inches (25 to 50 cm). The vegetation is dominated by sedges, mosses, willows, alder, and scattered black spruce. See *66* in table 6.

Sideric Cryaquods, loamy, nearly level to rolling, occur on slopes affected by seepage in close association with the Typic Cryorthods. The soils are moderately well drained and formed in loamy colluvial sediment. They are forested. See *111* in table 6.

In the NORTON SOUND HIGHLANDS the association occupies low rolling hills bordering the lower Yukon Valley. Elevations range from about 100 to 900 feet (30 to 275 m) above sea level. Most elevations below 700 feet (210 m) are covered with a thick mantle of silty material, probably loess from large nearby flood plains. The silt mantle thins with elevation and on a few hilltops bedrock is close to the surface. Soils on north-facing slopes and in low nearly level valleys and basins are underlain by ice-rich permafrost. Most of the soils are poorly drained and support forests of black spruce or a vegetative cover dominated by sedge tussocks, mosses, willows, alder, and low shrubs. Permafrost is generally deep or absent in soils on other slopes. Those soils are well drained and support a forest of white spruce, paper birch, and aspen.

Soils of the association provide habitat for wildlife, including moose and caribou. Soils with permafrost and steep slopes are poorly suited for any kind of

development, but most of the well drained forested soils with gentle to moderate gradients are potentially suitable for cultivation and generally have the fewest limitations for intensive uses, such as roads and buildings.

Principal components in the Norton Sound Highlands:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (30 percent) are poorly drained soils with permafrost that occupy valley bottoms, north-facing slopes, and foot slopes. Soils in the valley bottoms and on some of the foot slopes are forested with black spruce, but in other places the vegetation is mainly sedges, mosses, willows, alder, and low shrubs. The soils have a thick peaty surface mat over mottled dark gray silt loam that is perennially frozen with thick ice lenses below depths of 10 to 20 inches (25 to 50 cm). A thin layer darkened with organic matter commonly occurs directly above the permafrost table and commonly extends into the frozen material. In summer the soil above the frozen material is usually wet. See *65b* in table 6.

Typic Cryorthods, loamy, nearly level to rolling, (30 percent) are well drained soils without permafrost on low rolling hills. They support mixed stands of white spruce, paper birch, and aspen. Beneath a layer of forest litter, they have a thin gray surface layer (albic horizon) over dark reddish brown to brown silt loam about 12 to 18 inches (30 to 45 cm) thick (spodic horizon). The underlying material consists of olive to olive gray silt loam. See *120* in table 6.

Typic Cryorthods, loamy, hilly to steep, (20 percent) are well drained soils without permafrost that occur on all but north-facing slopes. The vegetation is a mixed forest of white spruce, paper birch, and aspen. The soils have a thin gray albic horizon and a dark reddish brown to brown spodic horizon about 12 to 18 inches (30 to 45 cm) thick over olive brown to olive gray silt loam. See *121* in table 6.

Pergelic Cryaquepts, loamy, nearly level to rolling, (15 percent) occur on low foot slopes and in draws affected by seepage. They are somewhat poorly to poorly drained and are moderately thick over permafrost. The vegetation is mainly alder, willow, dwarf birch, grasses, and a few black spruce. Typically, the soils have 3 to 6 inches (8 to 15 cm) of organic material over mottled dark gray silt loam that contains many streaks and patches of material darkened by organic matter. Depth to perennially frozen material is commonly between 20 to 30 inches (50 to 75 cm). See *72b* in table 6.

Other components (5 percent):

Typic Cryorthods, very gravelly, nearly level, are well drained soils on terraces. They are shallow over gravel and have no permafrost. The vegetation is a white spruce-paper birch forest. See *124a* in table 6.

Entic Cryorthods, sandy, nearly level to rolling, are on scattered low dunes and terraces. They formed in a few inches of silt loam over fine sand. The vegetation is a forest of aspen, paper birch, and white spruce. See *126* in table 6.

IQ13—Histic Pergelic Cryaquepts-Typic Cryorthods, loamy, hilly to steep association is in the following major land resource areas:

		Acres
175	Kuskokwim Highlands	2,461,000
177	Norton Sound Highlands	652,000
	Total	3,113,000

This association occupies rolling to moderately steep nonglaciated uplands bordering the Kuskokwim and lower Yukon Rivers (fig. 26). The landscape is dominated by rounded hills and bluffs separated by sloping valleys. Elevations range from 300 to 1,500 feet (90 to 450 m) in most areas, though a few higher hills are included. A mantle of silty loess derived from nearby flood plains covers most of the uplands, and thick deposits of colluvial sediment have accumulated in valleys and on foot slopes.

Soils on south-facing slopes under a forest of white spruce, paper birch, and quaking aspen are mostly well drained and have no permafrost. Poorly drained soils with permafrost occur on steep north-facing slopes and most lower slopes. The vegetation on these soils is either a forest of black spruce, or tundra dominated by sedges, mosses, willows, dwarf birch, and other low shrubs.

Some soils of minor extent are potentially suitable for cultivation, and many of the well drained soils are suitable for commercial forestry. The dominant soils, however, are poorly suited to those uses and have severe limitations for most types of intensive development.

Principal components:

Histic Pergelic Cryaquepts, loamy, hilly to steep, (30 percent) are poorly drained soils with permafrost that occupy north-facing slopes and steep foot slopes. The vegetation is either black spruce forest or tundra consisting of sedges, mosses, and low shrubs. Beneath a thick peaty surface mat, the soils consist of mottled gray or dark gray silt loam with black frost-churned streaks of organic matter. A thin layer darkened with organic material commonly occurs directly above ice-rich permafrost, which is 10 to 20 inches (25 to 50 cm) below the surface mat. During the summer the thawed soil material above the permafrost is usually wet. See *66* in table 6.

Typic Cryorthods, loamy, hilly to steep, (25 percent) are well drained soils without permafrost that occupy southerly slopes. The vegetation is a forest of white spruce and paper birch. The soils have a thin gray silt loam surface horizon (albic horizon) and a dark reddish brown to dark brown silt loam spodic horizon about 10 to 18 inches (25 to 45 cm) thick over olive to olive brown silt loam or gravelly silt loam. Depth to bedrock is generally more than 40 inches (1 m). See *121* in table 6.

Histic Pergelic Cryaquepts, loamy, nevel level to rolling, (15 percent) are poorly drained soils with permafrost that occupy valley bottoms and long low foot slopes. The vegetation is either a forest of black spruce or tundra dominated by sedges, mosses, willow, dwarf birch, and other low shrubs. The soils have a thick peaty surface mat over mottled gray silt loam that is perennially frozen below a depth of 10 to 20 inches (25 to 50 cm). During the summer, the thawed material above the permafrost is usually wet. See *65a* and *65b* in table 6.

Aeric Cryaquepts, loamy, nearly level to rolling, (10

Figure 26.—**Histic Pergelic Cryaquepts occupy north-facing slopes (to the right in the photograph) and gentle lower slopes under black spruce, sedges, and mosses. Typic Cryorthods under mixed forest are dominant on southerly slopes. South of Holy Cross.**

percent) are somewhat poorly drained soils formed in thick deposits of silty loess and colluvium on southerly foot slopes. They are commonly underlain by buried, isolated masses of ice. The vegetation is a forest of either white spruce and paper birch or black spruce. Beneath a fairly thin organic surface mat, the soils consist of mottled, dark brown and dark grayish brown silt loam that grades with depth to olive gray silt loam. See *58* in table 6.

Typic Cryorthods, very gravelly, hilly to steep, (10 percent) are well drained soils without permafrost that occupy the higher parts of southerly slopes. The vegetation is a sparse forest of stunted white spruce and paper birch and a heavy understory of dwarf birch and other shrubs. The soils formed in a thin mantle of silty loess over very gravelly material derived from weathered bedrock. Typically, they have a thin gray albic horizon and a reddish brown to brown spodic horizon about 8 to 12 inches (20 to 30 cm) thick over olive brown to brown very gravelly silt loam. Depth to bedrock is commonly between 20 and 40 inches (50 to 100 cm). See *125d* in table 6.

Other components (10 percent):

Pergelic Cryofibrists, nearly level, are very poorly drained soils in depressions in valley bottoms. They consist of deep fibrous peat derived from mosses and sedges. Depth to permafrost ranges from 10 to 20 inches (25 to 50 cm). The vegetation is mainly sedges, mosses, and low shrubs. See *28* in table 6.

Lithic Cryorthods, very gravelly, hilly to steep, are well drained soils on ridgetops above tree line. They are less than 20 inches (50 cm) thick over bedrock. Vegetation is dominantly dwarf birch, grasses, lichens, forbs, and low alpine shrubs. See *134* in table 6.

Lithic Ruptic-Entic Cryumbrepts, very gravelly, hilly to steep, are well drained soils on a few high ridgetops above tree line. They are shallow over bedrock. The vegetation is sparse alpine tundra dominated by dwarf birch, forbs, and grasses. See *98* in table 6.

Typic Cryorthods, very gravelly, nearly level, are well drained soils on a few gravelly terraces along streams. They formed in a thin mantle of silty loess over very gravelly and sandy alluvial sediment. The vegetation is a forest of paper birch, quaking aspen, and white spruce. See *124a* in table 6.

IQ14—Histic Pergelic Cryaquepts, loamy, nearly level to rolling-Typic Cryorthods, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
173 Alaska Range	109,000
174 Interior Alaska Lowlands	210,000
175 Kuskokwim Highlands	1,145,000
177 Norton Sound Highlands	47,000
Total	1,511,000

The association occurs in several areas west of the Alaska Range. Although the dominant soils in all areas are similar in many characteristics, there are some significant differences between the soils of relatively minor extent.

On the ALASKA RANGE and the INTERIOR ALASKA LOWLANDS the association occupies outwash plains and moraine hills in and just west of the Alaska Range. Braided flood plains of glacier-fed streams are included. Elevations range from about 700 feet (210 m) above sea level on low parts of the outwash plains to 1,800 feet (540 m) on the highest hills.

Most soils developed in thick deposits of gravelly glacial drift mantled with silty loess. In a few places on high hills the drift is shallow over weathered bedrock. Poorly drained soils with a shallow permafrost table are dominant on outwash plains, on foot-slopes, and in sloping valleys on moraine hills. These soils support forests of black spruce and tundra vegetation consisting of sedge tussocks, mosses, willows, dwarf birch, and other low shrubs. Well drained very gravelly soils without permafrost occur on moraine hills and low stream terraces. They are usually forested with white spruce, paper birch, and quaking aspen.

There are no extensive areas of development or intensive use on the association. Soils with the fewest limitations for buildings or construction commonly occur on low moraines and gravelly terraces near the flood plains. In general, the soils are not potentially suitable for cultivation or commercial forestry but provide fair to good quality habitat for a large variety of wildlife species, including moose and caribou.

Principal components in the Alaska Range and the Interior Alaska Lowlands:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (30 percent) are very poorly drained soils with a shallow permafrost table that occupy broad nearly level outwash plains and sloping valleys in moraine hills. They formed in silty loess and alluvium over gravelly glacial outwash and till. During the summer the soils are usually wet. The vegetation is either a forest of black spruce or tundra dominated by sedge tussocks, mosses, willows, dwarf birch, and other low shrubs. Beneath a thick mat of peaty organic material, the soils consist of mottled gray frost-churned silt loam. Depth to permafrost is about 10 to 20 inches (25 to 50 cm) below the organic mat. See *65a* in table 6.

Typic Cryorthods, very gravelly, hilly to steep, (25 percent) are well drained soils without permafrost that occupy moraine hills. Slopes are usually short and choppy. The soils support a forest of white spruce, paper birch, and quaking aspen. They developed in a thin gray albic horizon over a dark reddish-brown spodic horizon about 10 to 15 inches (25 to 40 cm) thick. The lower part of the spodic horizon extends into very gravelly sandy loam till. See *125c* and *125d* in table 6.

Histic Pergelic Cryaquepts, very gravelly, nearly level, (15 percent) are poorly drained soils with permafrost on outwash plains and low terraces bordering the larger rivers. They formed in very gravelly waterlaid sediment and, in places, are capped with a thin mantle of silt loam. Forests of black spruce and tundra dominated by mosses and shrubs are the two principal types of vegetation. The soils have a thick peaty surface mat over mottled dark gray gravelly silt loam. The gravel content increases with depth. The permafrost table is generally less than 30 inches (75 cm) below the peaty mat. See *68* in table 6.

Typic Cryorthods, very gravelly, nearly level to rolling, (10 percent) are well drained soils without permafrost that occur directly above escarpments and on low rolling moraines. They developed in very gravelly glacial drift. They support a forest of white spruce, paper birch, and aspen. Beneath a thin mat of moss and forest litter, the soils have a thin gray silty albic horizon over a dark reddish brown to brown very gravelly sandy loam spodic horizon about 10 to 15 inches (25 to 40 cm) thick that grades with depth to olive brown very gravelly sand. See *124a* and *124b* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (10 percent) are poorly drained soils with permafrost on north-facing slopes of moraine hills. The dominant vegetation is black spruce, mosses, willows, and low shrubs. The soils have a thick peaty surface mat over mottled, dark gray, frost-churned very gravelly and stony silt loam. Depth to permafrost is usually less than 20 inches (50 cm). See *69* in table 6.

Other components (10 percent):

Pergelic Cryofibrists, nearly level, are poorly drained fibrous organic soils in scattered depressions in moraines and outwash plains; depth to permafrost is generally less than 20 inches (50 cm); the vegetation is dominated by mosses, sedges, and low shrubs. See *28* in table 6.

Typic Cryorthents, very gravelly, nearly level, are excessively drained, gray soils on low terraces along streams. They consist of coarse very gravelly stream deposits and have no permafrost. The vegetation is dominantly cottonwood, willow, and alder. See *12a* and *12b* in table 6.

Typic Cryofluvents, loamy, nearly level, are well drained soils on low natural levees bordering major streams. They consist of silty and sandy alluvial sediment underlain by sand, gravel, and cobblestones. The vegetation is dominated by cottonwood, white spruce, willow, and alder. See *7a* and *7c* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, are well drained soils on a few high hills above tree line. The vegetation is mostly alpine shrubs, grasses, and forbs. See *137* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, are well drained stony soils on a few sharp peaks above tree line. The vegetation is a sparse cover of low alpine plants. See *20* in table 6.

In the KUSKOKWIM HIGHLANDS and the NORTON SOUND HIGHLANDS the association occupies unglaciated low hills separated by broad gently sloping valleys. Elevations range from about 500 to 1,500 feet (150 to 450 m) above sea level. Most of the soils in valleys and on foot slopes consist of silty colluvial sediment and have a shallow permafrost table. On low hills the dominant soils formed in a thin mantle of silt loam over very gravelly material derived from weathered rock. Some of the soils on bluffs near large rivers formed in loess

derived from nearby flood plains. Forests of black spruce are common on poorly drained soils in valleys and on north-facing slopes. Some poorly drained soils support tundra vegetation dominated by sedge tussocks, mosses, and low shrubs. On well drained soils on low hills and south-facing slopes, the dominant vegetation is a forest of white spruce, paper birch, and aspen.

Most of the soils provide good habitat for a wide variety of wildlife, including moose and caribou. Although the dominant soils have severe limitations for most types of development, there are a few well drained, gently sloping loamy soils without permafrost (Typic Cryorthods) that are potentially suitable for cultivation and commercial forestry. Those soils generally occur in scattered areas on south-facing foot slopes of low hills and on low bluffs and terraces near large streams. They support a forest of white spruce, paper birch, and aspen.

Principal components in the Kuskokwim Highlands and the Norton Sound Highlands:

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (40 percent) are poorly drained soils with a shallow permafrost table that occupy broad sloping valleys and long foot slopes. The vegetation is mainly sedge tussocks, mosses, low shrubs, and forests of black spruce. The soils have a thick peaty surface mat and a mottled dark gray silt loam horizon that commonly contains streaks of frost-churned organic matter. Depth to permafrost is about 10 to 20 inches (25 to 50 cm). A thin layer of organic matter commonly occurs near the surface or directly above the perennially frozen material. During the summer thaw period, water is perched above the permafrost and the soils are usually wet. See *65a* and *65b* in table 6.

Typic Cryorthods, very gravelly, hilly to steep, (25 percent) are well drained soils without permafrost on south-facing slopes. They developed in a thin mantle of silty loess over very gravelly silt loam derived from weathered rock. Depth to unweathered bedrock is usually more than 40 inches (1 m). The vegetation is a forest dominated by white spruce, paper birch, and quaking aspen. Directly beneath a surface layer of forest litter, the soils have 1 to 2 inches (2 to 5 cm) of gray silt loam (albic horizon) over 10 to 15 inches (25 to 40 cm) of dark reddish brown to brown silt loam or gravelly silt loam (spodic horizon) that grades with depth to olive brown very gravelly silt loam. The gravel content increases with depth. See *125d* in table 6.

Typic Cryorthods, loamy, nearly level to rolling, (15 percent) are well drained soils without permafrost on the lower parts of south-facing slopes and low bluffs and terraces near large rivers. They developed in thick deposits of silty material. They support a forest dominated by white spruce, paper birch, and quaking aspen. Beneath a thin mat of forest litter and partially decomposed organic matter, the soils have 1 to 2 inches (2 to 5 cm) of gray silt loam (albic horizon) over 10 to 15 inches (25 to 40 cm) of dark reddish brown to brown silt loam (spodic horizon) that grades with depth to olive or olive brown silt. Some of these soils are underlain by very gravelly weathered rock or colluvial material at a depth of 30 to 40 inches (75 to 100 cm). See *120* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (10 percent) are poorly drained soils with permafrost that occur on north-facing slopes. The vegetation is sedges, mosses, low shrubs, and scattered stands of black spruce. The soils have a thick peaty surface mat over mottled dark gray frost-churned very gravelly and stony silt loam that is perennially frozen below a depth of 10 to 20 inches (25 to 50 cm). See *69* in table 6.

Other components (10 percent):

Pergelic Cryofibrists, nearly level, are fibrous organic soils in parts of valley bottoms. The peat is perennially frozen below depths of 10 to 30 inches (25 to 75 cm). See *28* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, are well drained soils on the tops of a few high hills above tree line. The vegetation is dominated by dwarf birch, other low shrubs, grasses, and forbs. See *137* in table 6.

Pergelic Cryaquepts, loamy, nearly level to rolling, are poorly drained soils on foot slopes, closely associated with the Histic Pergelic Cryaquepts. They formed in gravelly colluvium and are perennially frozen below 20 to 40 inches (50 to 100 cm). The dominant vegetation is a forest of black spruce. See *72a* and *72b* in table 6.

Typic Cryaquents, loamy, nearly level, occupy low wet areas along streams. They consist of stratified sandy and silty alluvial sediment and have a permanent high water table. The vegetation is sedges, willows, and other water-tolerant plants. See *2b* in table 6.

IQ15—Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling association is in the following major land resource areas:

	Acres
172 Copper River Plateau	225,000
173 Alaska Range	62,000
174 Interior Alaska Lowlands	866,000
175 Kuskokwim Highlands	892,000
176 Interior Alaska Highlands	279,000
177 Norton Sound Highlands	319,000
179 Bering Sea Islands	946,000
Total	3,589,000

This association is widespread in interior and western Alaska. It occupies outwash plains and piedmont slopes at the base of mountains, upland valleys, and, on Nunivak Island, beds of ancient volcanic rock. The dominant soils are poorly drained and are underlain by permafrost. Topographic patterns and the proportions of less extensive soils are not the same in all areas.

On the COPPER RIVER PLATEAU the association occupies outwash plains adjacent to the Alaska Range and the Wrangell Mountains. The dominant soils formed in very gravelly glacial drift. They support either tundra dominated by sedges, mosses, and shrubs or a black spruce forest. They are poorly drained and have severe limitations for any intensive use. Well drained associated soils on somewhat higher terraces and moraines are not suitable for agriculture or commer-

cial forestry but have fewer limitations for construction.

Principal components in the Copper River Plateau:

Histic Pergelic Cryaquepts, very gravelly, nearly level, (55 percent) are poorly drained soils with a shallow permafrost table that occupy broad outwash plains in the northern part of the Copper River Plateau. The vegetation is tundra dominated by sedges, mosses, dwarf birch, willow, and low shrubs. A few soils support a forest of black spruce. The soils have a thick peaty surface mat over mottled gray very gravelly loam or silt loam. At a depth of about 10 to 20 inches (25 to 50 cm) beneath the surface mat, the soils are perennially frozen and contain lenses of clear ice. See *68* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (20 percent) are poorly drained soils with a shallow permafrost table that occupy long foot slopes and slight depressions in outwash plains. The principal vegetation is tundra dominated by sedge tussocks, mosses, and low shrubs. The soils have a thick peaty surface mat over mottled dark gray to greenish gray silt loam. At a depth of about 10 to 20 inches (25 to 50 cm) beneath the peaty surface mat, the soil is perennially frozen and contains thick clear lenses of ice. See *65a* in table 6.

Typic Cryorthents, very gravelly, nearly level to rolling, (10 percent) are well drained soils on undulating to rolling outwash plains and nearly level terraces bordering streams. The dominant vegetation is tall willows, dwarf birch, and scattered patches of white spruce and aspen. Stands of cottonwood are common on terraces bordering streams. The soils consist of dark grayish brown very gravelly silt loam to sandy loam grading with depth to loose sand, gravel, and cobblestones. See *12b* in table 6.

Pergelic Cryofibrists, nearly level, (10 percent) are very poorly drained, perennially frozen organic soils in shallow basins and depressions in outwash plains. The vegetation is mainly sedges, mosses, and low shrubs. The peat consists of dark brown, relatively undecomposed fibrous sedge and moss peat. The permafrost table is shallow. During the summer the thawed material above it is wet and spongy. See *28* in table 6.

Pergelic Cryorthods, very gravelly, nearly level to rolling, (5 percent) are well drained soils on high undulating to rolling moraines. The vegetation is mainly dwarf birch, willow, shrubs, grasses, lichens, and scattered stands of white spruce and aspen. Beneath a thin peaty surface mat the soils have a thin albic horizon and a reddish brown to brown spodic horizon 5 to 10 inches (12 to 25 cm) thick developed in gravelly silt loam to sandy loam. The substratum is loose very gravelly sand. Although the mean annual soil temperature is believed to be below freezing, there is seldom enough moisture for ice lenses to form. See *136* in table 6.

In the ALASKA RANGE, the INTERIOR ALASKA LOWLANDS, and the KUSKOKWIM HIGHLANDS the association occupies outwash plains, piedmont slopes, and broad valleys in and adjacent to mountains. The dominant soils formed in very gravelly glacial drift and colluvial material. The vegetation is either a black spruce forest or tundra dominated by sedges and mosses. Included moraines and terraces with no permafrost have forests of white spruce, paper birch, aspen, and cottonwood.

No soils in the association are suitable for agriculture, but the well drained soils can be used for tree production. The dominant soils have severe limitations for most kinds of construction, but the well drained soils have few limitations.

Principal components in the Alaska Range, the Interior Alaska Lowlands, and the Kuskokwim Highlands:

Histic Pergelic Cryaquepts, very gravelly, nearly level to undulating, (75 percent) are poorly drained soils with a shallow permafrost table that occupy broad outwash plains. The dominant vegetation is a forest of black spruce, but in many areas it is tundra consisting of sedges, mosses, and low shrubs. Beneath a thick peaty surface mat the soils consist of mottled gray very gravelly silt loam or sandy loam that is perennially frozen below a depth of 10 to 20 inches (25 to 50 cm). See *68* in table 6.

Typic Cryorthods, very gravelly, nearly level to rolling, (10 percent) are well drained soils on undulating to rolling moraines at low elevations. The dominant vegetation is a forest of white spruce, paper birch, and aspen. The soils have a thin albic horizon and a dark reddish brown to brown spodic horizon about 8 to 15 inches (20 to 40 cm) thick developed in very gravelly sandy loam. The substratum consists of olive very gravelly sand with cobblestones. See *124a* and *124b* in table 6.

Typic Cryorthents, very gravelly, nearly level, (10 percent) are excessively drained soils on stream terraces. The vegetation is mainly tall willows and scattered stands of cottonwood. The soils are made up of gray sandy and silty sediment that is shallow over loose sand, gravel, and cobblestones. See *12a* and *12b* in table 6.

Other components (5 percent):

Typic Cryochrepts, very gravelly, hilly to steep, are well drained soils formed in very gravelly silt loam derived from partially weathered bedrock. The vegetation is a forest of aspen, white spruce, and paper birch. See *86* in table 6.

Aeric Cryaquepts, very gravelly, nearly level to rolling, are on foot slopes and are somewhat poorly drained. They consist of shallow silt loam or sandy loam over gravelly colluvium. The vegetation is a forest of black spruce. See *59* in table 6.

Typic Cryofluvents, loamy, nearly level, occupy natural levees and stream terraces. They are well drained. They consist of dark gray silt and fine sand sediment. The dominant vegetation is a forest of cottonwood. See *7a* and *7c* in table 6.

Pergelic Cryofibrists, nearly level, are very poorly drained organic soils that occupy scattered muskegs. See *28* in table 6.

In the INTERIOR ALASKA HIGHLANDS and the NORTON SOUND HIGHLANDS the association occupies broad valleys and foot slopes in generally hilly terrain. The soils formed in material that has been transported by water. A few knolls and low hills are included. The vegetation is dominantly tundra made up of low shrubs, sedges,

and mosses. Soils of the area are generally unsuited to agriculture or forestry and, because of permafrost, have severe limitations for most kinds of construction.

Principal components in the Interior Alaska Highlands and the Norton Sound Highlands:

Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling, (85 percent) are very poorly drained soils with a shallow permafrost table that occupy broad valleys and foot slopes. The vegetation is tundra dominated by low shrubs, willows, sedges, mosses, and lichens. Beneath a thick peaty surface mat the soils consist of mottled dark gray very gravelly and stony silt loam to sandy loam that is perennially frozen below a depth of 10 to 20 inches (25 to 50 cm). The soils commonly contain dark churned streaks of organic material. See *68* in table 6.

Typic Cryofluvents, loamy, nearly level, (10 percent) are well drained soils on low terraces and natural levees bordering streams. The principal vegetation is cottonwood forest, willows, alder, and scattered stands of white spruce. The soils consist of dark gray stratified silty and sandy sediment with lenses of buried organic matter. The sediment is about 25 to 50 inches (65 to 125 cm) thick over sand, gravel, and cobblestones. See *7a* and *7c* in table 6.

Other components (5 percent):

Pergelic Cryofibrists, nearly level, are very poorly drained perennially frozen organic soils in scattered depressions. See *28* in table 6.

Pergelic Cryochrepts, very gravelly, hilly to steep, are well drained brown soils on knolls and hills. Ice-rich permafrost, if present, is at a great depth. The vegetation is dominated by low shrubs, grasses, and lichens. See *93* in table 6.

In the BERING SEA ISLANDS the association occupies a rolling lava plain interrupted by low volcanic cones on Nunivak Island. Dunes are common along the coasts. Tundra vegetation covers the entire area. No agriculture or forestry is possible, but the tundra is utilized by established herds of reindeer and muskox. Because of permafrost, limitations for most construction are severe.

Principal components in the Bering Sea Islands:

Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling, (80 percent) are poorly drained soils on low rolling lava plains. The vegetation is tundra dominated by sedges, mosses, and shrubs. The soils have a thick peaty surface mat over mottled dark gray very gravelly and stony loam derived from ancient lava beds. The depth to permafrost is generally less than 24 inches (60 cm). See *68* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level, (15 percent) are poorly drained soils with a shallow permafrost table that occupy the lower parts of lava plains, especially near the mouths of streams. The vegetation is tundra consisting mainly of sedges, mosses, and low shrubs. Beneath a thick peaty surface mat the soils consist of mottled gray silt loam. The depth to permafrost is about 10 to 30 inches (25 to 75 cm). See *65b* in table 6.

Other components (5 percent):

Pergelic Cryoborolls, very gravelly, hilly to steep, are well drained very gravelly soils on volcanic cones. The soils are nonacid and have a surface layer darkened by organic matter. See *107* in table 6.

Pergelic Cryopsamments, sandy, hilly to steep, are excessively drained gray sandy soils on coastal dunes. See *24* in table 6.

IQ16—Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling-Pergelic Cryoborolls, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
177 Norton Sound Highlands	413,000
178 Western Alaska Coastal Plains and Deltas	47,000
179 Bering Sea Islands	257,000
Total	717,000

This association occupies low plains and basaltic hills in areas south of Norton Sound and on islands in the Bering Sea. Small crater lakes and low volcanic cones are common in many areas. Elevations range from near sea level on low coastal plains to about 1,600 feet (490 m) on a few volcanic hills. The vegetation is tundra dominated by sedges, mosses, grasses, lichens, and low shrubs. Patches of tall alder and willow are common near lakes and along streams.

Most soils of the association formed in very gravelly and stony material derived chiefly from ancient beds of basaltic rock. Deposits of silty and sandy volcanic ash in a few areas and alluvial sediment near the mouths of streams are included. Except for a few sandy hills and dunes along the coast, the entire association is underlain by permafrost.

Vegetation on most of the soils provides habitat for wildlife and, in several places, is grazed by reindeer. On Nunivak Island there is also an established herd of muskox. The soils are not suitable for cultivation or forestry, and most of them have severe limitations for all intensive uses. The better sites for construction are on well drained soils on gently sloping and rolling hills.

Principal components:

Histic Pergelic Cryaquepts, very gravelly, nearly level, (45 percent) are poorly drained soils with permafrost that occupy nearly level plains underlain by basaltic rock. The vegetation is tundra dominated by sedges, mosses, and low shrubs. The soils have a thick peaty surface mat over mottled dark gray very gravelly and stony silt loam or sandy loam. The permafrost table is generally 10 to 20 inches (25 to 50 cm) beneath the surface mat. See *68* in table 6.

Pergelic Cryoborolls, very gravelly, hilly to steep, (20 percent) are well drained, very gravelly and stony soils that occupy low hills and volcanic cones. Although the mean annual soil temperature is below freezing, there is seldom enough moisture retained in the very gravelly material to form thick ice lenses. The vegetation is tundra dominated by grasses, lichens, and a variety of forbs and shrubs. Beneath a thin surface mat of organic material the soils have a black or very dark brown upper horizon about 8 to 12 inches (20 to 30 cm) thick developed in gravelly or very gravelly and stony loam to sandy loam. The underlying material is gen-

erally dark grayish brown or olive brown very gravelly loam or sandy loam. See *107* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (15 percent) are poorly drained very gravelly and stony soils with permafrost on lower hillsides. The vegetation is tundra dominated by sedges, mosses, and low shrubs. Beneath a thick peaty surface mat, the soils consist of mottled gray very gravelly and stony loam. Depth to permafrost ranges from about 10 to 30 inches (25 to 75 cm) below the surface mat. See *69* in table 6.

Pergelic Cryoborolls, very gravelly, nearly level to rolling, (10 percent) are well drained very gravelly and stony soils on low hills. The vegetation is tundra consisting mainly of grasses, lichens, forbs, and shrubs. The soils have a thin organic surface mat and a black or very dark brown upper horizon about 8 to 12 inches (20 to 30 cm) thick over dark grayish brown to olive very gravelly and stony loam or sandy loam. The mean annual soil temperature is below freezing, but the perennially frozen substratum does not retain enough moisture for the formation of large ice lenses. See *106* in table 6.

Other components (10 percent):

Histic Pergelic Cryaquepts, loamy, nearly level, are poorly drained silty soils with a shallow permafrost table. They occupy low plains near the mouths of streams. See *65b* in table 6.

Typic Cryandepts, loamy, hilly to steep, are well drained soils formed in silty and sandy volcanic ash deposited on a few hills south of Norton Sound. See *45* in table 6.

Lava flows consist of nearly barren lava rock. See *143* in table 6.

IQ17—Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling-Humic Cryorthods, very gravelly, hilly to steep association is in the following major land resource area:

	Acres
175 Kuskokwim Highlands	801,000

This association occupies terraces and moraines in broad valleys and basins north of Iliamna Lake. Small lakes, many streams, and narrow flood plains are included. Elevations range from about 700 feet (210 m) in the valley bottoms to 2,000 feet (600 m) on a few high hills.

Although the vegetation is dominantly tundra, forests of black spruce are common on foot slopes, and open stands of black and white spruce are scattered on low moraine hills (fig. 27). Tall shrubs, cottonwood, and a few white spruce grow on low gravelly terraces bordering the flood plains.

Most soils of the association formed in very gravelly glacial outwash and till that is commonly capped with a very thin mantle of silty loess and volcanic ash. Sandy alluvial sediment is common on narrow flood plains, and deposits of peat occur in scattered muskegs. Most of the soils in valleys and on foot slopes are underlain by permafrost, but in well drained soils on moraines permafrost is deep or absent. The dominant soils have severe limitations for intensive use and development and are not potentially suitable for cultivation or forestry.

Principal components:

Histic Pergelic Cryaquepts, very gravelly, nearly level to moderately sloping, (45 percent) are poorly drained soils with permafrost that occupy terraces, foot slopes, and broad valley bottoms. The vegetation is of two general types—black spruce forest and tundra dominated by sedges, mosses, and shrubs. The soils have a thick mat of organic material over a mottled dark gray horizon developed in very gravelly loam. The permafrost table is usually 10 to 20 inches (25 to 50 cm) below the surface mat. See *68* in table 6.

Humic Cryorthods, very gravelly, hilly to steep, (40 percent) are well drained soils on hilly moraines. Permafrost is deep or absent. The vegetation commonly is dwarf birch, willows, and grasses growing in open stands of white or black spruce. A few of the soils on south-facing slopes support forests of paper birch and white spruce and an understory of grasses and shrubs. Under a surface mat of organic matter, the soils have a thin gray albic horizon and a spodic horizon developed in a thin mantle of gravelly silt loam to sandy loam loess and volcanic ash over very gravelly and sandy glacial till. The spodic horizon, about 12 to 18 inches (30 to 45 cm) thick, is black or very dark reddish brown in the upper few inches, grading with depth to dark brown or brown. The very gravelly substratum is normally olive or olive brown. See *131d* in table 6.

Pergelic Cryofibrists, nearly level, (10 percent) are very poorly drained soils that consist of fibrous moss and sedge peat. They occur in small muskegs in broad valley bottoms. The dominant vegetation is sedges, mosses, shrubs, and other water-tolerant plants that commonly grow in muskegs. The organic material is perennially frozen in all but the upper layers, which are wet and spongy in the summer. See *28* in table 6.

Other components (5 percent):

Typic Cryorthents, very gravelly, nearly level, are excessively drained, very gravelly soils that occupy low stream terraces. See *12a* in table 6.

Typic Cryofluvents, loamy, nearly level, are well drained, stratified silty and sandy soils that occupy natural levees on flood plains. See *7a* in table 6.

IQ18—Histic Pergelic Cryaquepts-Typic Cryochrepts, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
175 Kuskokwim Highlands	2,012,000
176 Interior Alaska Highlands	2,463,000
177 Norton Sound Highlands	942,000
180 Brooks Range	72,000
Total	5,489,000

This association occupies strongly dissected highlands in areas northwest of the Alaska Range and in the southern foothills of the Brooks Range. High hills and ridges separated by deep valleys dominate the landscape. Elevations generally range from about 500 to 2,500 feet (150 to 750 m) above sea level, but higher peaks are included in some areas. Except for a few valleys near high mountains, the areas are nonglaciated, and most of the soils developed in material weathered from the local rock. On hills near major rivers, the weathered material is mantled with loess from nearby flood plains.

Figure 27.—**Humic Cryorthods with open stands of spruce on moraine hills and Histic Pergelic Cryaquepts with tundra vegetation in swales and depressions. Whitefish Lake.**

Most of the soils in valley bottoms and on high ridges and north-facing slopes are poorly drained and are shallow over permafrost. Soils on south-facing slopes below tree line are well drained and have no permafrost. The poorly drained soils are covered by sedges, mosses, low shrubs, and scattered forests of black spruce. Most of the well drained soils support forests of white spruce, paper birch, and aspen. On high ridges and peaks the vegetation is mainly alpine grasses, forbs, and shrubs.

The principal soils in the association are too wet or too steep for agriculture and have severe limitations for intensive use and development. The well drained forested soils have potential for commercial forestry.

Principal components:

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (35 percent) are poorly drained soils with permafrost that occupy north-facing slopes and upland valleys. The vegetation is mainly sedges, mosses, low shrubs, and scattered stands of black spruce. Beneath a thick peaty surface mat, the soils have a mottled, dark gray, very gravelly silt loam horizon. Depth to permafrost is about 10 to 24 inches (25 to 60 cm) beneath the surface mat. See *69* in table 6.

Typic Cryochrepts, very gravelly, hilly to steep, (25 percent) are well drained soils that occupy south-facing slopes below tree line. Permafrost is deep or absent. The vegetation is a forest of white spruce, paper birch, and aspen. Beneath a thin surface mat of organic material, the soil has a dark brown or brown horizon about 10 to 20 inches (25 to 50 cm) thick developed in very gravelly silt loam or sandy loam over weathered bedrock. See *86* in table 6.

Lithic Cryochrepts, very gravelly, hilly to steep, (10 percent) are well drained soils that are shallow over bedrock. They occur on some ridgetops and on steep south-facing slopes. The vegetation on high ridges is alpine grasses, forbs, and shrubs. On south-facing slopes, at lower elevations, the soils support a forest of white spruce, paper birch, and aspen. Under a thin organic surface mat, the soils have a brown cambic horizon developed in very gravelly silt loam or sandy loam 10 to 20 inches (25 to 50 cm) thick over bedrock. See *92a* and *92b* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, (10 percent) are poorly drained soils with permafrost on ridges above the tree line. The vegetation is mainly sedges, mosses, dwarf birch, and other shrubs. The soils have a thin peaty surface mat and a mottled dark gray horizon developed in very gravelly and stony loam or sandy loam. Depth to permafrost is about 15 to 30 inches (40 to 75 cm). See *76* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (5 percent) are poorly drained soils with a shallow permafrost table on foot slopes and in a few valley bottoms. The vegetation is sedge tussocks, mosses, shrubs, and scattered stands of black spruce. The soils have a thick peaty surface mat and a mottled dark gray horizon developed in silty colluvium. Depth to permafrost is about 10 to 20 inches (25 to 50 cm). See *65a* and *65b* in table 6.

Typic Cryochrepts, loamy, hilly to steep, (5 percent) are well drained soils without permafrost on low hills close to major rivers. They support a forest of white spruce, paper birch, and aspen. Under a thin mat of forest litter, the soil has a brown horizon about 12 to 20 inches (30 to 50 cm) thick developed in deep silty loess. See *82* in table 6.

Other components (10 percent):

Typic Cryorthents, loamy, nearly level to rolling, are deep, well drained silt loams on a few low hills near major rivers. Vegetation is a forest of white spruce, paper birch, and aspen. See *10a* and *10b* in table 6.

Typic Cryumbrepts, very gravelly, hilly to steep, are well drained soils on a few south-facing slopes near tree line. Vegetation is dominantly grass and alder. See *94* in table 6.

Aeric Cryaquepts, loamy, nearly level to rolling, are somewhat poorly drained silt loams on some foot slopes. Vegetation is a forest of either black spruce or white spruce and paper birch. See *58* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, are well drained soils with deep permafrost that occupy high ridgetops. Vegetation is alpine tundra. See *20* in table 6.

Lithic Cryorthents, very gravelly, hilly to steep, are well drained soils that are shallow over bedrock. They occur on low mountain peaks. The vegetation is alpine tundra. See *16* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, are well drained soils with deep permafrost in hilly alpine areas. The vegetation is alpine tundra. See *100* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, are well drained soils with deep permafrost on a few slopes above tree line. The vegetation is alpine tundra. See *137* in table 6.

Typic Cryorthods, loamy, hilly to steep, are well drained silty soils on foothills in areas close to the Brooks Range. Vegetation is a forest of white spruce and paper birch. See *121* in table 6.

Rough mountainous land consists of areas of bare rock on a few sharp peaks. See *145* in table 6.

IQ19—Histic Pergelic Cryaquepts-Typic Cryorthods, very gravelly, hilly to steep association is in the following major land resource area:

	Acres
175 Kuskokwim Highlands	4,136,000

This association occupies extensive, maturely dissected areas of the Kuskokwim Highlands. High rounded hills, long ridges, and deep sloping valleys dominate the landscape (fig. 28). The elevation generally ranges from about 250 feet (80 m) on the Kuskokwim River to 2,500 feet (750 m) on the hilltops, but a few higher peaks are included.

Most of the bedrock in these areas is covered with very gravelly residual and colluvial material. On a few low bluffs and foot slopes along the Kuskokwim River, the bedrock is capped with a thick mantle of loess. Permafrost underlies north-facing slopes, foot slopes, and many valley bottoms. In these places the dominant vegetation is tundra or stunted black spruce. Forests of white spruce, paper birch, and aspen occupy steep south-facing slopes at elevations generally below 1,200 feet (370 m). At higher elevations the vegetation is alpine tundra.

The principal soils of this association are too wet or too steep for agriculture. South-facing slopes below tree line are suitable for commercial forestry. Steep slopes and the presence of permafrost severely limit the suitability of the association for construction.

Principal components:

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (30 percent) are poorly drained very gravelly and stony soils on north-facing slopes and foot slopes. The permafrost table is shallow. The vegetation is mosses, sedges, and shrubs or stunted black spruce forest and a ground cover of moss. Typically, under a thick peaty surface mat, the soils consist of gray mottled silt loam to very gravelly and stony silt loam that is perennially frozen below depths of 10 to 24 inches (25 to 60 cm). See *69* in table 6.

Typic Cryorthods, very gravelly, hilly to steep, (25 percent) are well drained very gravelly silt loams on steep slopes with aspects other than north. They commonly range from 20 to 40 inches (50 to 100 cm) in depth to bedrock, but some are deeper. The soils have a thin albic horizon and a dark reddish brown to dark brown gravelly silt loam spodic horizon over dark grayish brown very gravelly silt loam. On bluffs near the Kuskokwim River the very gravelly material is commonly capped with a mantle of loess. The vegetation is a forest of white spruce, paper birch, and aspen. See *125d* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, (10 percent) are very gravelly loams or silt loams on slopes and ridges directly above tree line. Depth to bedrock commonly ranges from 20 to 40 inches (50 to

Figure 28.—Very gravelly Histic Pergelic Cryaquepts under black spruce or tundra vegetation on north-facing slopes and foot slopes and Typic Cryorthods with white spruce-birch-aspen forest on other steep slopes. Pergelic Cryorthods under shrubby alpine vegetation in areas above tree line. Near McGrath.

100 cm). The vegetation is mainly alpine shrubs, lichens, grasses, and mosses. Typically, under a surface mat of partially decomposed organic matter, soils have an albic horizon about 1 inch (2 cm) thick and a dark yellowish brown gravelly silt loam spodic horizon about 8 inches (20 cm) thick. The substratum consists of olive very gravelly and stony sandy loam. Although the mean annual soil temperature is below freezing, not enough moisture is retained in the coarse material to form ice-rich permafrost. See *137* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (10 percent) are poorly drained soils in valley bottoms and on long foot slopes. They formed in thick deposits of silty colluvial sediment and have a shallow permafrost table. During the summer thaw the material above the permafrost is nearly always wet. The dominant vegetation is sedges, mosses, and shrubs, but a few areas support stands of stunted black spruce. Typically, these soils have a thick peaty surface mat over gray mottled silt loam that is perennially frozen below depths of about 6 to 24 inches (15 to 60 cm). The frozen material commonly contains thick lenses of clear ice. See *65a* in table 6.

Lithic Ruptic-Entic Cryumbrepts, very gravelly, hilly to steep, (5 percent) are well drained very gravelly silty soils on hills and ridges well above tree line. Depth to bedrock is less than 20 inches (50 cm). The vegetation is sparse alpine tundra with many berry patches. Typically, under a mat of partially decomposed organic matter, the vegetated soils have very dark, acid, very gravelly silt loam upper layers rich in

organic matter. The subsoil and the unvegetated soils consist of grayish brown to olive brown very gravelly silt loam that overlies bedrock.

Although the mean annual soil temperature is below freezing, ice-rich permafrost is usually absent. See *98* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, (5 percent) are poorly drained very gravelly and stony loamy soils mainly in small drainageways and seepage spots in ridges above tree line. Permafrost is generally 20 to 40 inches (50 to 100 cm) below the surface. In the summer, the material above the permafrost is wet. The vegetation, which is mainly short sedges and mosses, is interrupted by many barren frost scars. Typically, under a thin mat of organic matter the soil consists of gray mottled very gravelly or stony loam. See *76* in table 6.

Typic Cryorthods, loamy, nearly level to rolling, (5 percent) are deep well drained silty soils on low south-facing foot slopes in a few places along the Kuskokwim River. The vegetation is a forest of paper birch and white spruce. The soils have a thin albic horizon over a reddish brown to brown silt loam spodic horizon about 12 to 18 inches (30 to 45 cm) thick. The underlying material is olive gray silt loam. See *120* in table 6.

Other components (10 percent):

Lithic Cryorthents, very gravelly, hilly to steep, are gray soils that are shallow over bedrock and occur on tops of high hills and ridges above tree line. The vegetation is alpine tundra. See *16* in table 6.

Lithic Cryorthods, very gravelly, hilly to steep, are soils with thin albic and spodic horizons over shallow bedrock. They occupy the upper slopes of hills and ridges directly above tree line. The vegetation is largely shrubs. See *134* in table 6.

Rough mountainous land is mostly bare rock and rubble on a few included peaks and ridges. See *145* in table 6.

IQ20—Pergelic Cryaquepts-Pergelic Ruptic-Histic Cryaquepts, loamy, nearly level to rolling association is in the following major land resource areas:

	Acres
181 Arctic Foothills	518,000
182 Arctic Coastal Plain	152,000
Total	670,000

This association occupies low rounded hills bordered by coastal plains and low parts of the Arctic Foothills. The hilltops are broad with smooth, gentle, convex slopes and are strongly patterned with barren or sparsely vegetated circular frost scars. Most of the hillsides have long slopes with gradients ranging from about 7 to 12 percent. The entire association is underlain by thick permafrost, and the vegetation is typical arctic tundra. Elevations range from about 300 feet (90 m) on foot slopes to 1,000 feet (300 m) on the highest hilltops.

The dominant soils are poorly drained and formed in thick deposits of loamy material derived chiefly from weathered nonacid and calcareous shales. A few very gravelly well drained soils occur on narrow ridgetops. The areas include a few thaw lakes and are drained mainly by small streams and waterways flowing from the sides of moderately sloping valleys.

Soils of the association are too cold for cultivation and, largely because of the underlying ice-rich permafrost, have severe limitations for construction. The areas are used mainly by caribou and other arctic wildlife.

Principal components:

Pergelic Cryaquepts, loamy, nearly level to rolling, (25 percent) are poorly drained soils on low ridges and in broad valleys. The vegetation is dominantly sedges and mosses, but in many places it is interrupted by unvegetated frost scars. Typically, the soils have mottled dark gray and dark grayish brown silt loam or silty clay loam horizons that are strongly frost-churned and streaked with black organic material. Beneath the vegetation the soil thaws to a depth of about 10 inches (25 cm), but in frost scars the depth of thaw is about 20 inches (50 cm). The unconsolidated perennially frozen material generally contains thick masses of clear ice. See *72b* in table 6.

Pergelic Ruptic-Histic Cryaquepts, loamy, nearly level to rolling, (25 percent) are poorly drained soils commonly on broad hilltops. Closely spaced circular frost scars that support little or no vegetation (fig. 29) occupy about one-third of the surface area. The soils between the frost scars support a dense thick mat of vegetation that is mainly mosses, sedges, lichens, and low shrubs. Beneath the thick vegetative mat and in the frost scars is mottled dark gray to dark grayish brown silt loam or silty clay loam that contains many frost-churned streaks of black organic material. The permafrost table is usually less than 6 inches (15 cm) below the vegetative mat, but ranges to 20 inches (50 cm) deep in the frost scars. The soils are nonacid to calcareous. They generally contain thick masses of clear ice in the perennially frozen material. See *78* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (15 percent) are poorly drained soils in broad valleys and on long foot slopes. They commonly support a cover of sedge tussocks, mosses, lichens, and low shrubs. Typically, beneath an organic mat ranging from 8 to 16 inches (20 to 40 cm) in thickness, the soils consist of mottled dark gray, nonacid silt loam that is frost-churned and streaked with black organic material. The depth of thaw is usually less than 6 inches (15 cm) below the vegetative mat, and the perennially frozen material contains thick masses of clear ice. See *65b* in table 6.

Pergelic Cryaquolls, loamy, nearly level to rolling, (15 percent) are poorly drained soils in scattered swales and broad valley bottoms. They support a vegetative cover dominated by low shrubs, sedges, mosses, and forbs. Typically, beneath the organic mat the soils have a black, nonacid, mucky silt loam upper layer over mottled dark gray, frost-churned, loamy material derived from calcareous rock. Depth to ice-rich permafrost is usually less than 10 inches (25 cm) below the organic mat. See *101* in table 6.

Pergelic Ruptic-Histic Cryaquepts, clayey, nearly level to rolling, (10 percent) are poorly drained soils in scattered areas on hilltops. They formed in clayey material weathered from light-colored fine-grained shale. Closely spaced, circular, unvegetated frost scars occupy 40 to 50 percent of the total surface area. Be-

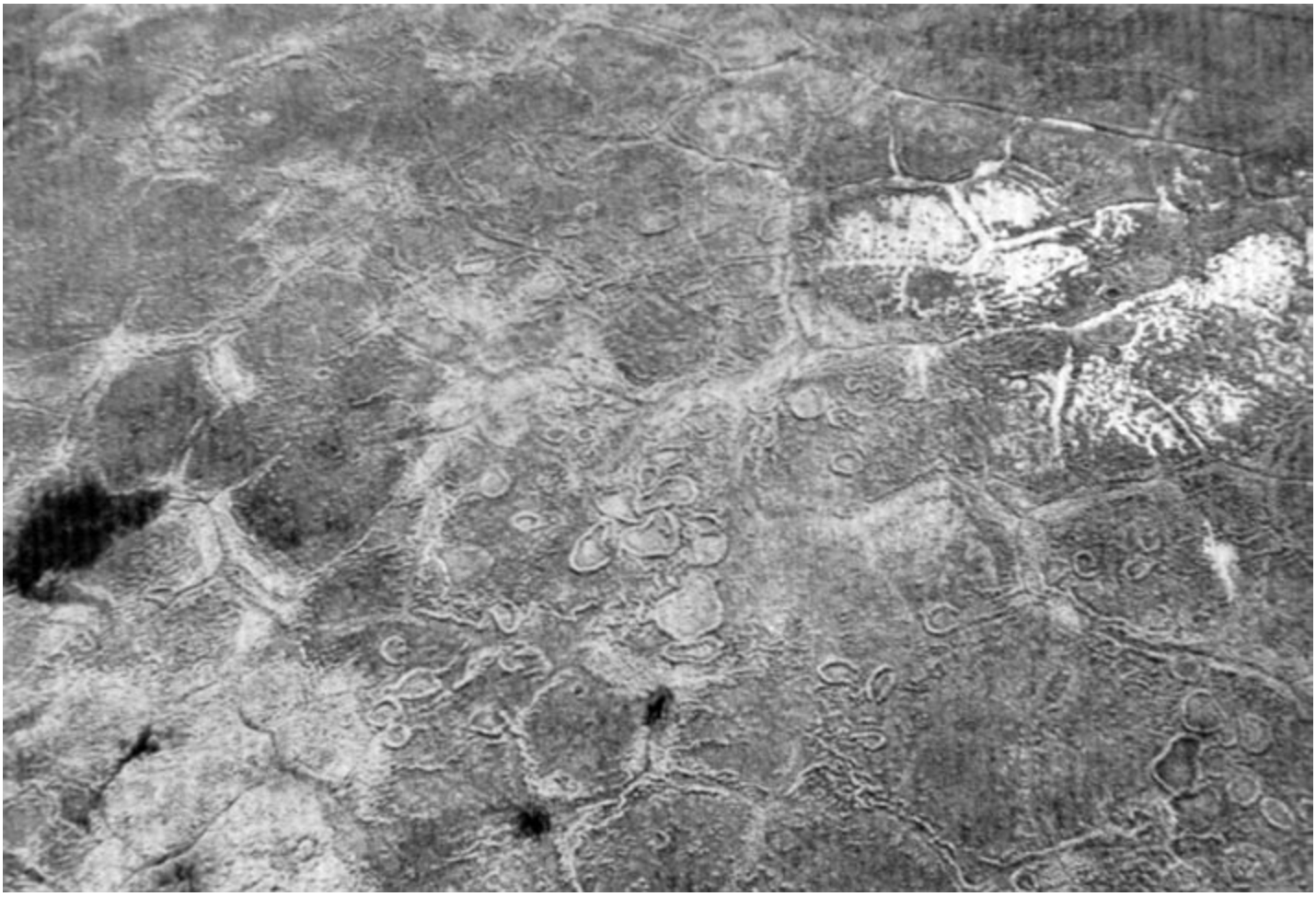

Figure 29.—Sparsely vegetated frost scars in polygons. Low hills between Colville and Sagavanirktok Rivers.

tween the frost scars the soils support a thick cover of sedges, mosses, and low shrubs. The soils in the frost scars and beneath the vegetative mat consist of mottled gray, nonacid silty clay loam or clay loam streaked with pale brown. The material above the permafrost is frost-churned and commonly contains a few black patches of organic matter. Depth to ice-rich perennially frozen material ranges from about 6 inches (15 cm) under the vegetative mat to about 20 inches (50 cm) in the frost scars. See *77* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, (10 percent) are well drained soils on a few sharp narrow ridgetops. The vegetation, which is commonly sparse, is mainly dwarf shrubs, grasses, and forbs. Typically, beneath a thin mat of organic matter the soils consist of grayish brown very gravelly silt loam or silty clay loam. The gravel content generally increases with depth, and the fragments are usually sharp and angular. Though the mean annual soil temperature is below freezing, the soils do not retain enough moisture to form thick lenses of ice. See *20* in table 6.

IQ21—Pergelic Cryaquepts-Pergelic Cryopsamments, sandy, nearly level to rolling association is in the following major land resource area:

	Acres
182 Arctic Coastal Plain	2,367,000

This association occupies a large part of the Arctic Coastal Plain. The landscape is dominated by nearly level low tundra dotted with shallow thaw lakes. There are many undulating and rolling sand dunes, especially in areas bordering the flood plains of major streams and some of the larger lakes (fig. 30). Most of the dunes are stabilized by vegetation, though some dunes adjacent to streams are active. Elevations range from a few feet above sea level near the coast to about 150 feet (45 m) in areas farther inland. The vegetation is arctic tundra dominated by sedges, mosses, grasses, lichens, and low shrubs and forbs.

Most of the soils in the association consist of sandy eolian, alluvial, and marine deposits, but a few formed in loamy material. Poorly drained soils with a shallow permafrost table occupy most of the nearly level areas and the broad swales between dunes. The soils on dunes consist of eolian sand and, although they are perennially frozen below a depth of 30 to 40 inches (25 to 100 cm),

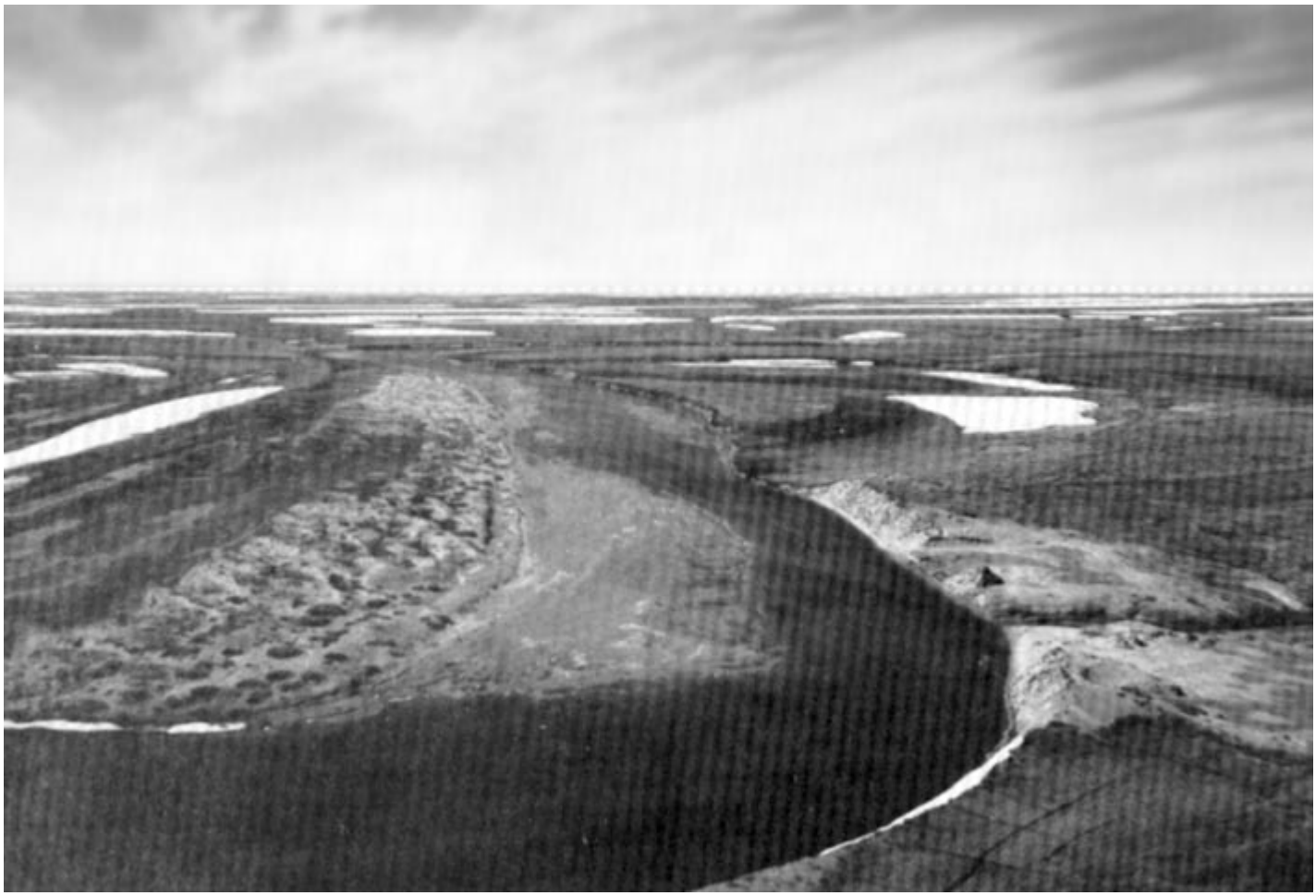

Figure 30.—Sandy Pergelic Cryaquepts occupy lower areas and Pergelic Cryopsamments occur on low dunes. Some dunes adjacent to streams are active and support little or no vegetation. Arctic coastal plain south of Barrow.

they seldom retain enough moisture for large ice crystals to form.

Very severe climatic limitations preclude any agricultural development in the area. The permafrost imposes severe limitations on construction activities. Soils of the association provide wildlife habitat for species that frequent the arctic tundra, including migrating herds of caribou and nesting waterfowl. The area is potentially suitable for reindeer grazing.

Principal components:

Pergelic Cryaquepts, sandy, nearly level, (40 percent) are poorly drained sandy soils with a shallow permafrost table that occupy nearly level areas and broad swales between sand dunes. The vegetation is tundra dominated by sedges, mosses, and low shrubs. Beneath a thin surface layer of organic material, the soils consist of dark gray fine sand or loamy fine sand that is perennially frozen at depths ranging from about 10 to 20 inches (25 to 50 cm). In summer, water is perched above the frozen material, and the soils are usually wet. See *74* in table 6.

Pergelic Cryopsamments, sandy, nearly level to rolling, (30 percent) are excessively drained sandy soils with permafrost on low stabilized dunes. The vegetation is mainly grasses, lichens, low shrubs, and forbs. Beneath a thin surface layer of organic matter the soils consist of olive brown fine sand with a few thin discontinuous streaks of dark organic material. The permafrost table generally occurs about 20 to 30 inches (50 to 75 cm) below the surface. See *23* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level, (15 percent) are poorly drained soils with a shallow permafrost table that occupy low nearly level plains between areas of sand dunes. They commonly have a polygonal surface pattern. The dominant vegetation is sedges, mosses, and low shrubs. Beneath a thick peaty surface layer the soils consist of loam that commonly contains black frost-churned streaks of organic material, especially in a zone directly above and below the permafrost table. Ice-rich permafrost generally occurs at depths of less than 10 inches (25 cm) below the surface mat. See *65b* in table 6.

Pergelic Cryaquepts, loamy, nearly level, (10 percent) are poorly drained soils with a shallow permafrost table on nearly level plains and are closely associated

with the Histic Pergelic Cryaquepts. The surface is commonly patterned with circular frost scars and polygons. The vegetation is mainly sedges, mosses, and low shrubs. Typically, the soils have a thin surface mat of organic matter over mottled gray frost-churned silt loam to sandy loam that is perennially frozen below a depth of about 10 to 20 inches (25 to 50 cm). See *72b* in table 6.

Other components (5 percent) :

Pergelic Cryofibrists, nearly level, are fibrous organic soils with shallow permafrost that occupy shallow basins. The vegetation is dominantly sedges and mosses. See *28* in table 6.

Dune land consists of active sand dunes near the flood plains of major streams. It supports no vegetation. See *141* in table 6.

IQ22—Pergelic Cryaquepts, very gravelly, nearly level association is in the following major land resource areas:

	Acres
180 Brooks Range	72,000
181 Arctic Foothills	1,338,000
182 Arctic Coastal Plain	1,265,000
Total	2,675,000

This association occupies low terraces, braided flood plains, and broad alluvial fans bordering major streams in northern Alaska (fig. 31). Elevations range from sea level on plains bordering the coast to about 2,000 feet (600 m) in the Brooks Range. The dominant soils consist of very gravelly stream deposits underlain by permafrost. Low parts of the association are commonly flooded by runoff from spring snowmelt and heavy summer rainstorms in the mountainous watershed areas. The vegetation is arctic tundra dominated by sedges, mosses, and low shrubs.

Figure 31.—Intensive industrial development on very gravelly Pergelic Cryaquepts. Near mouth of Sagavanirktok River at Prudhoe Bay.

Soils of the association provide habitat for wildlife that frequent the arctic tundra and are potentially suitable for reindeer grazing. Most of the soils have severe limitations for construction, but well drained very gravelly soils of minor extent that occur near escarpment edges on low terraces, slightly above the flood plains, are among the most suitable soils for building sites, roads, and other intensive uses in the Arctic.

Principal components:

Pergelic Cryaquepts, very gravelly, nearly level, (65 percent) are poorly drained soils with permafrost on low terraces, flood plains, and alluvial fans braided with small secondary stream channels. Shallow floods of short duration are common in the spring and summer on soils in low areas along streams, but most of the soils on terraces escape flooding. The vegetation is arctic tundra dominated by sedges, mosses, and low shrubs. Typically, the soils have a thin surface mat of organic material over a thin layer of gray stratified silt loam and fine sand that is usually less than 15 inches (40 cm) thick over very gravelly and sandy stream deposits. Depth to permafrost ranges from about 15 to 30 inches (40 to 75 cm). Many soils east of the Colville River are calcareous. See *75* in table 6.

Pergelic Cryorthents, very gravelly, nearly level, (10 percent) are well drained soils above escarpment edges on low terraces. They consist of very gravelly alluvial deposits. Soil temperatures at moderate depth are continually below freezing, but the coarse material seldom retains enough moisture to form large ice lenses. The vegetation is arctic tundra dominated by grasses, lichens, mosses, and low shrubs and forbs. Beneath a thin surface mat of organic material, the soils consist of grayish brown or dark grayish brown very gravelly sand that commonly contains many cobblestones. See *19* in table 6.

Pergelic Cryaquepts, loamy, nearly level, (10 percent) are poorly drained soils with shallow permafrost that occur on parts of low terraces and flood plains. The vegetation is dominantly sedges, mosses, and low shrubs. Beneath a thin peaty surface mat, the soils consist of mottled gray stratified silt loam and fine sand that contain dark streaks of buried organic matter. Depth to ice-rich permafrost is generally less than 20 inches (50 cm). See *72b* in table 6.

Pergelic Cryaquepts, sandy, nearly level, (10 percent) are poorly drained sandy soils with permafrost on flood plains and swales between low undulating dunes. The vegetation is mainly sedges and low shrubs. The soils have a thin peaty surface layer over gray or mottled dark grayish brown fine sand that commonly contains streaks or thin layers of buried organic matter. Depth to permafrost ranges from about 10 to 30 inches (25 to 75 cm). See *74* in table 6.

Other components (5 percent):

Pergelic Cryofibrists, nearly level, are very poorly drained fibrous organic soils in slight depressions on terraces. They are shallow over permafrost. The vegetation is mainly sedges. See *28* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level, are poorly drained soils on terraces. They are shallow over ice-rich permafrost. The vegetation is mainly sedges, mosses, and low shrubs. See *65b* in table 6.

Pergelic Cryopsamments, sandy, nearly level to rolling, are excessively drained soils on low undulating dunes bordering flood plains. The vegetation is grasses, forbs, and low shrubs. See *23* in table 6.

Riverwash consists of unvegetated, frequently flooded deposits of sand and gravel. See *144* in table 6.

IQ23—Pergelic Cryaquepts, very gravelly, nearly level to rolling-Pergelic Cryorthods, very gravelly, hilly to steep association is in the following major land resource area:

	Acres
175 Kuskokwim Highlands	2,411,000

This association occupies a broad upland area between the valleys of the Nushagak and Holitna Rivers in the southern part of the Kuskokwim Highlands. Low hills, ridges, and broad sloping stream valleys covered with tundra vegetation dominate the landscape. Elevations range from about 800 to 2,300 feet (240 to 700 m) above sea level. Most of the association is underlain by permafrost, and some of the long foot slopes are patterned with solifluction lobes. Included at lower elevations are a few gravelly stream terraces that are free of permafrost and forested with scattered stands of white spruce. The bedrock of the area is exposed on a few peaks and ridges, but in most places it is covered by deposits of very gravelly colluvium mantled with silty mixed loess and volcanic ash. The eastern parts of the association, near the Alaska Range, have been glaciated and consist mainly of very gravelly glacial till and outwash deposits.

The dominant soils of valleys and foot slopes, under a vegetative cover of sedges and mosses, are poorly drained and have a permafrost table that is commonly less than 30 inches (75 cm) below the surface. Well drained very stony and gravelly soils occur on most of the hills and ridges under alpine tundra vegetation. On terraces and moraines at lower elevations are a few well drained soils without permafrost that support open stands of white spruce with an understory of dwarf birch and willow.

Soils of the association are not potentially suitable for cultivation or forestry, and most have moderate to severe limitations for intensive uses. Primarily, they provide habitat for wildlife, including moose, caribou, bear, and a wide variety of smaller mammals.

Principal components:

Pergelic Cryaquepts, very gravelly, nearly level to rolling, (45 percent) are poorly drained and somewhat poorly drained soils with permafrost. They occur in broad valleys and on long foot slopes that are commonly patterned with solifluction lobes. They formed in very gravelly and stony colluvial material. They support tundra vegetation dominated by sedges, mosses, and shrubs. Typically, beneath a thin peaty surface mat, the soils consist of mottled dark gray to dark grayish brown very gravelly and stony silt loam or sandy loam. The permafrost table is generally about 20 to 30 inches (50 to 75 cm) below the surface. See *75* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, (25 percent) are well drained soils on hills and ridges. The vegetation is mainly grasses, forbs, lichens, mosses, low alpine tundra shrubs, and patches of dwarf birch. In a typical profile, there is a thin gray albic hori-

zon and a dark reddish brown spodic horizon that is about 6 to 12 inches (15 to 30 cm) thick and developed in very gravelly and stony silt loam or sandy loam. The content of stones and gravel commonly increases with depth, and in places the substratum is mainly shattered partially weathered bedrock. Though the mean annual soil temperature is below freezing, there is seldom enough moisture in the very gravelly material for ice-rich permafrost to form. See *137* in table 6.

Typic Cryorthods, very gravelly, nearly level to rolling, (10 percent) are well drained soils without permafrost on narrow terraces along streams at lower elevations. They commonly support open forests of white spruce and an understory of dwarf birch and willows. The ground cover is mainly mosses and low shrubs. Typically, beneath a thin mat of moss and forest litter, the soils have a thin gray albic horizon and a dark reddish brown spodic horizon developed in 10 to 20 inches (25 to 50 cm) of silt loam over thick deposits of coarse sand and gravel. See *124a* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, (10 percent) are well drained soils on high ridgetops under a cover of grasses, forbs, and alpine shrubs. Typically, they have a very dark brown, acid, gravelly loam or silt loam surface horizon 6 to 10 inches (15 to 25 cm) thick over very gravelly and stony sandy loam. The content of stones and gravel generally increases with depth and, in places, bedrock is 20 to 40 inches (50 to 100 cm) below the surface. Though the mean annual soil temperature is below freezing, large ice lenses or solidly frozen layers seldom form in the coarse material. See *100* in table 6.

Lithic Cryorthents, very gravelly, hilly to steep, (10 percent) are excessively drained shallow soils on sharp peaks and ridgetops. The vegetation is generally a sparse cover of low alpine tundra plants. Beneath the thin vegetative mat, the soils consist of grayish brown very gravelly and stony loam or sandy loam less than 20 inches (50 cm) thick over bedrock. The mean annual soil temperature is below freezing. See *16* in table 6.

IQ24—Pergelic Cryaquepts-Pergelic Cryorthents, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
176 Interior Alaska Highlands	1,012,000
177 Norton Sound Highlands	4,404,000
180 Brooks Range	2,567,000
181 Arctic Foothills	2,338,000
Total	10,321,000

This association occupies areas in and adjoining the south-central and western parts of the Brooks Range and on the Seward Peninsula. Elevations range from 1,500 to 6,000 feet (450 to 1,800 m) in and near the Brooks Range and from near sea level to about 2,800 feet (850 m) on the Seward Peninsula. The area is made up of high ridges separated by narrow valleys and includes many rocky peaks. The soils formed in colluvial material derived from local rock or, at lower elevations, glacial till.

The vegetation on long side slopes of ridges, concave slopes of drainageways, and north-facing slopes is mostly low shrubs, sedge tussocks, and mosses. Ridgetops, rounded hills, and steep south-facing slopes support low shrubs, dryas, grasses, and lichens. At lower elevations, some steep south-facing slopes are covered by white spruce, tall shrubs, and grasses.

This association is made up of poorly drained and well drained soils with permafrost. The poorly drained soils occupy long uniform slopes, foot slopes, valley bottoms, and steep north-facing slopes.The well drained soils occur on high ridges and steep south-facing slopes. Solifluction lobes, frost boils, stone stripes, and other frost features are common.

Soils of this association are generally too wet or too steep for cultivated crops, forestry, and most construction purposes. The soils are used primarily by wildlife, including caribou, wolves, small mammals, and birds.

Principal components:

Pergelic Cryaquepts, very gravelly, hilly to steep, (35 percent) are poorly drained soils on broad sloping ridges and long steep mountainsides and hillsides. They formed mostly in gravelly and stony colluvial material but at some lower elevations in very gravelly glacial deposits. The soils consist of a few inches of organic matter and a thin layer of dark gray silt loam over mottled dark gray very gravelly silt loam. Permafrost is at a depth of about 16 inches (40 cm). Bedrock is generally deep but in places is shallower than 40 inches (1 m). Solifluction lobes and frost scars are common. The vegetation includes willows, dwarf birch, sedges, and mosses. See *76* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, (20 percent) are well drained soils on steep slopes of ridges, hills, and mountains. They formed in very gravelly colluvium under a cover that includes low shrubs, grass, dryas, and lichens. Typically, under a very thin mat of coarse organic material there is a thin dark brown gravelly silt loam layer over dark yellowish brown and olive brown very gravelly silt loam. It is underlain by shattered bedrock at a depth of about 14 inches (35 cm). See *20* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, (15 percent) are well drained soils on ridges, hills, and mountains under vegetation dominated by low shrubs. In many places they are in close association with Pergelic Cryorthents and differ from those soils only in that they have fairly thick dark brown upper horizons. See *100* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (15 percent) are poorly drained soils on north-facing hillsides and mountainsides, on foot slopes, and in drainageways. Most of these soils formed in very gravelly colluvium, but in some valleys they consist of glacial till with a silty mantle. The vegetation includes low shrubs, sedges, mosses, and lichens. Typically, under a thick mat of organic matter, the soils have a thin layer of black mucky silt loam over mottled gray very gravelly silt loam. Permafrost is about 10 inches (25 cm) below the mineral surface. A few soils with gentle or moderate slopes are included. See *69* in table 6.

Pergelic Ruptic-Histic Cryaquepts, very gravelly, hilly to steep, (5 percent) are poorly drained soils on rounded ridges and long side slopes. They formed in very gravelly and stony residual and colluvial material. Polygons, solifluction lobes, and other patterned surface features are common. The vegetation includes low

shrubs, forbs, sedges, mosses, and lichens, interrupted by barren or nearly barren frost scars. In troughs between polygons and in other low positions in the microrelief, there is a thick mat of organic matter over mottled gravelly silt loam. In centers of polygons and other high points, the organic mat is thin or absent. Permafrost is shallow under the thick mat and is moderately deep under the frost scars. The soil material is frost-churned and contains streaks and patches of organic matter and mineral material of varying texture. See *80* in table 6.

Rough mountainous land (5 percent) occupies barren peaks, ridges, and talus slopes, commonly at higher elevations. It supports only scattered vegetation. See *145* in table 6.

Other components (5 percent):

Pergelic Cryoborolls, very gravelly, hilly to steep, are well drained soils on steep foot slopes in the western part of the Brooks Range, normally in calcareous material. The vegetation includes low shrubs, dryas, grass, and lichens. See *107* in table 6.

Typic Cryochrepts, very gravelly, hilly to steep, are well drained soils on steep south-facing slopes at low elevation, mostly south of the Brooks Range. Permafrost is deep or absent. The soils support a forest of white spruce, paper birch, and aspen. See *86* in table 6.

Lithic Ruptic-Entic Cryoborolls, very gravelly, hilly to steep, are well drained soils over calcareous rock on high ridges. They are calcareous throughout. Under sparse tundra vegetation, the soils have a dark reddish brown to dark brown upper horizon. Under many barren patches this horizon is absent. See *105* in table 6.

Lithic Ruptic-Entic Cryumbrepts, very gravelly, hilly to steep, are well drained soils on high ridges. They overlie schist bedrock. They have thick dark upper horizons where vegetated, but this horizon is absent under barren patches. The vegetation is low tundra plants. See *98* in table 6.

IQ25—Pergelic Cryaquepts-Pergelic Cryochrepts, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
169 South Central Alaska Mountains	156,000
172 Copper River Plateau	14,000
173 Alaska Range	2,306,000
176 Interior Alaska Highlands	10,169,000
Total	12,645,000

On the INTERIOR ALASKA HIGHLANDS this association occupies unglaciated steep hills and mountains. Elevations are generally between 1,000 and 5,000 feet (300 and 1,500 m) (fig. 32). Some included peaks are higher than 6,500 feet (2,000 m). Most of the association is above tree line. Most alpine areas have a dense cover of sedge tussocks, low shrubs and forbs, and mosses, but many areas with exceptionally good surface drainage support a sparse vegetation dominated by low shrubs and forbs, grasses, and lichens. Below the tree line the principal vegetation is a forest of black spruce and willows. At the lowest elevations within the association, steep south-facing slopes and natural levees on broad flood plains support a forest of white spruce, paper birch, and aspen.

The dominant soils are poorly drained, but soils within the association range from poorly drained to well drained. Most soils formed in very gravelly or flaggy colluvial material weathered from local bedrock. They are generally shallow over shattered bedrock on very steep side slopes, but gradually become deeper toward the base of the slopes. The soils under vegetation dominated by sedge tussocks or black spruce are wet and have ice-rich permafrost at shallow depths. Well drained soils occur under sparse shrubby vegetation on narrow high ridges and upper parts of steep slopes and under white spruce-birch-aspen forest on steep southerly slopes and natural levees at low elevations. Patterned ground features, including low mounds, solifluction lobes, frost boils, and stone stripes, occur commonly at higher elevations.

This association is too cold and steep for cultivation and has only scattered areas of trees suitable for harvesting. Most of the soils have severe limitations as construction sites. The vegetation provides habitat for moose, caribou, wolves, small mammals, and birds.

Principal components in the Interior Alaska Highlands:

Pergelic Cryaquepts, very gravelly, hilly to steep, (40 percent) are poorly drained soils that occupy broad ridgetops, hillsides and mountainsides, and valley bottoms at high elevations. They formed in very gravelly and stony material weathered from bedrock. Solifluction lobes, frost scars, and other frost features are common. The vegetative cover includes sedges, low shrubs and forbs, mosses, and lichens. The soil consists of a few inches of partially decomposed organic matter, a thin layer of mottled dark grayish brown fine gravelly silt loam, and gray very gravelly silt loam. The permafrost table is at depths greater than 2 feet (60 cm). See *76* in table 6.

Pergelic Cryochrepts, very gravelly, hilly to steep, (30 percent) are well drained soils on slopes of hills and ridges in areas above tree line. They formed in very gravelly material under a cover of low shrubs and forbs, grasses, and lichens. The soils have a thin dark surface horizon and a dark brown cambic horizon formed in silty material. Below this is olive gravelly silt loam that becomes more gravelly with depth. Bedrock occurs in places at depths of 24 to 60 inches (60 to 150 cm) and is exposed on some very steep slopes. See *93* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, (10 percent) are well drained soils on narrow ridges above tree line. They formed in very gravelly material under a sparse cover of low alpine tundra vegetation.

Typically, under a very thin surface layer of well-decomposed organic matter, these soils have olive gray gravelly silt loam horizons. The gravel content increases with depth. Reaction ranges from very strongly acid to moderately alkaline, depending on the local bedrock. The depth to fractured rock ranges from a few inches to more than 40 inches (1 m). See *20* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (10 percent) are very poorly drained soils on steep north-facing hillsides and mountainsides under a cover of sedges, low shrubs, and mosses at high ele-

Figure 32.—Very gravelly Pergelic Cryaquepts with solifluction pattern on hillsides. Pergelic Cryochrepts occur on ridges with good surface drainage. West of Bettles.

vations and black spruce, low shrubs, and mosses at lower elevations. Typically, under a thick peaty mat, the soils are mottled dark gray very gravelly silt loam or loam. Permafrost is usually at a depth of less than 18 inches (45 cm). In places the soils are stony. The depth to shattered bedrock is about 10 inches to 40 inches (25 to 100 cm). See *69* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to steep, (5 percent) are poorly drained soils that occupy toe slopes and narrow valley bottoms. They formed in silty colluvium under a thick cover of sedge tussocks, low shrubs and forbs, and mosses.

Typically, these soils have a thick mat of organic matter over mottled dark gray silt loam with pockets and lenses of organic matter. Permafrost occurs at a depth of less than 18 inches (45 cm). See *65a* and *66* in table 6.

Other components (5 percent):

Pergelic Cryorthods, very gravelly, hilly to steep, are well drained soils on high ridges and steep slopes under alpine tundra vegetation or, on some south-facing slopes, a forest of stunted white spruce and paper birch. They have very thin albic and spodic horizons. Ice-rich permafrost, if present, is deep. See *137* in table 6.

Typic Cryochrepts, very gravelly, hilly to steep, are well drained soils with brown cambic horizons. They occupy steep south-facing slopes under a forest of white spruce and paper birch. See *86* in table 6.

Aeric Cryaquepts, loamy, nearly level to rolling, are moderately well drained soils formed in deep silty deposits on foot slopes. In places they are underlain by deeply buried masses of ice. The vegetation is a forest of either black spruce or white spruce and paper birch. See *58* in table 6.

In the SOUTH CENTRAL ALASKA MOUNTAINS, the COPPER RIVER PLATEAU, and the ALASKA RANGE areas this association occupies the northern foothills of the Alaska Range and the Wrangell Mountains. Elevations range mostly from 1,500 to 5,000 feet (450 to 1,500 m) above sea level, but a few peaks are over 6,000 feet (1,800 m).

Most of the association is above tree line. Steep higher slopes have a sparse cover of low shrubs and forbs, grasses, and lichens. Broad ridges, high valleys, and steep north-facing slopes have a dense cover that includes sedge tussocks, low shrubs, and mosses. Steep south-facing slopes and hilly moraines at lower elevations have a cover of tall brush or white spruce, paper birch, and aspen. Some narrow valleys at lower elevations have a black spruce forest.

The soils have developed dominantly in glacial till, with a thin mantle of volcanic ash or loess in places. Bedrock outcrops on peaks and ridges and loose rubble occurs in many high areas. Most soils are poorly drained. Well drained soils have developed in very gravelly material at the foot of high ridges and on some south-facing slopes and hilly moraines at lower elevations.

The soils in this association are too cold or too steep for cultivation. There are almost no forests suitable for harvesting. Most of the soils have severe limitations as construction sites. The vegetation provides habitat for a variety of wildlife species, including caribou and moose.

Principal components in the South Central Alaska Mountains, the Copper River Plateau, and the Alaska Range:

Pergelic Cryaquepts, very gravelly, hilly to steep, (40 percent) are poorly drained soils that occupy broad high ridges, valleys, and footslopes and steep north-facing slopes. They formed in very gravelly weathered rock or glacial till under a cover of low shrubs and forbs, mosses, and, in some areas at lower elevations, black spruce.

Typically, under a mat of partly decomposed organic matter, the soils have a thin layer of dark grayish brown gravelly silt loam over mottled gray very gravelly loam or silt loam. Permafrost occurs at shallow depths. The organic mat is commonly thin, but in some depressions and valleys it may be as much as 14 inches (35 cm) thick. Frost scars, solifluction lobes, and other frost features are common. See *76* in table 6.

Pergelic Cryochrepts, very gravelly, hilly to steep, (35 percent) are well drained soils on high ridges and south-facing slopes of somewhat lower hills and moraines. They formed in weathered bedrock material or glacial till under a cover of low shrubs and forbs or, at lower elevations, a sparse forest of stunted white spruce, aspen, and dwarf birch.

Typically, these soils have a thin black surface layer that is high in organic matter and is underlain by a dark brown silty cambic horizon. The substratum is olive very gravelly silt loam or loam. In places bedrock is at a depth of 20 to 40 inches (50 to 100 cm). See *93* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, (15 percent) are well drained soils on high benches and ridges. They formed in very gravelly or stony residual material under a cover of low shrubs and forbs, grasses, and lichens.

Typically, under a very thin surface layer of fine organic matter, the soils are olive gray gravelly silt loam in which the gravel content increases with depth. Depth to bedrock is 20 to more than 40 inches (50 to 100 cm). See *20* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, (5 percent) are well drained soils on slopes of ridges, benches, and hills near tree line. They formed in glacial moraines, small outwash plains, and, in places, residual material over rock. A layer of volcanic ash is common at the surface. The vegetation is dominantly scattered spruce and tall alpine shrubs.

Typically, these soils have two sequences of thin albic and spodic horizons. The upper sequence formed in silty volcanic ash. The lower sequence is very gravelly silt loam or loam. Depth to the bottom of the second sequence is less than 20 inches (50 cm). The soils are very strongly acid. See *137* in table 6.

Other components (5 percent):

Typic Cryochrepts, very gravelly, hilly to steep, are well drained soils with brown cambic horizons that occupy terraces and moraines at lower elevations. They formed in a thin layer of loess over gravelly and sandy glacial drift under a forest of white spruce, paper birch, and aspen. See *86* in table 6.

Rough mountainous land includes barren rocky ridges and peaks and talus slopes. Except in a few pockets and cracks there is not enough soil to support vegetation. See *145* in table 6.

IQ26—Pergelic Cryaquepts-Pergelic Cryorthods, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
173 Alaska Range	424,000
175 Kuskokwim Highlands	1,917,000
Total	2,841,000

This association occupies western foothills of the Alaska Range and other hilly and mountainous areas between the Alaska Range and the lower Kuskokwim River. Elevations range from about 1,000 to 4,000 feet (300 to 1,200 m) above sea level. Prominent hills and ridges with long steep colluvial slopes separated by many small narrow stream valleys dominate the landscape.

Bedrock is exposed on sharp peaks, but is covered by very gravelly and stony colluvial material or glacial till elsewhere. Poorly drained soils with a shallow permafrost table are common on the lower slopes and in valleys. The vegetation on these soils is mainly sedges and mosses. Well drained very gravelly soils, commonly shallow over bedrock, are dominant on the upper hillsides and ridgetops under a cover of low shrubs and other alpine plants. Although these soils have a mean annual temperature below freezing, they seldom retain enough moisture for the formation of ice-rich permafrost.

Soils of this association are not suitable for cultivation, forestry, or grazing by livestock other than reindeer. Most of them have severe limitations for construction. Primarily, they provide habitat for moose, caribou, and many small mammals and birds.

Principal components:

Pergelic Cryaquepts, very gravelly, hilly to steep, (40 percent) are poorly drained soils with permafrost that occur on the lower slopes of steep hillsides and in valleys. The vegetation is mainly sedges, mosses, and low shrubs. Nearly barren frost scars are common in some areas. Beneath the vegetation and in the frost scars the soils consist of mottled gray or dark gray, frost-churned very gravelly and stony silt loam or sandy loam. The permafrost table is 20 to 40 inches (50 to 100 cm) below the surface. See *76* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, (25 percent) are well drained soils commonly on upper hillsides and ridges under a cover of alpine vegetation dominated by low shrubs, lichens, short grasses, and forbs. Typically, the soils have a thin gray albic horizon and a dark reddish brown to yellowish brown spodic horizon, 8 to 12 inches (20 to 30 cm) thick, developed in very gravelly sandy loam or silt loam material. On very steep slopes at higher elevations the soils are commonly only 20 to 40 inches (50 to 100 cm) thick over bedrock. Although the mean annual soil temperature is below freezing, the very gravelly material does not have sufficient moisture for ice-rich permafrost to form. See *137* in table 6.

Lithic Cryorthents, very gravelly, hilly to steep, (20 percent) are well drained soils, shallow over bedrock, on high ridgetops and very steep slopes. The vegetation is alpine tundra, dominantly low shrubs, lichens, mosses, short grasses, and forbs. Typically, the soils consist of grayish brown very gravelly and stony sandy loam less than 20 inches (50 cm) thick over bedrock. Although the mean annual soil temperature is below freezing, ice-rich permafrost seldom forms in the gravelly material. See *16* in table 6.

Rough mountainous land (15 percent) consists of bare rock and rubble on high peaks. There is little or no vegetation other than patches of lichen. See *145* in table 6.

IR1—Typic Cryochrepts, loamy, nearly level to rolling association is in the following major land resource area:

	Acres
174 Interior Alaska Lowlands	2,052,000

On the Yukon Flats this association occupies low terraces interrupted by lakes and muskegs and, in a few places, very low hills or dunes. Elevation is generally less than 700 feet (210 m). The soils formed principally in calcareous loess. The dominant soil is suitable for cultivation, commercial forestry, and construction sites.

In the Tanana Valley this association occupies outwash plains near major rivers and bordering the northern foothills of the Alaska Range. The landscape is nearly level to undulating with areas of rolling elongated dunes. The elevation ranges from about 400 feet (120 m) to 2,000 feet (600 m) near the Alaska Range. The soils formed in moderately deep or deep loess over sand or very gravelly sand. Well drained soils at elevations of 1,500 feet or less are potentially suitable for cultivation, forestry, and construction sites.

Principal components:

Typic Cryochrepts, loamy, nearly level to rolling, (65 percent) are well drained soils on terraces and outwash plains. They formed in silty loess deposited over waterlaid sand or very gravelly sand. The vegetation is a forest of white spruce, paper birch, or quaking aspen. Many areas have been severely burned. Under a thin mat of coarse organic matter the soils have a brown cambic horizon less than 24 inches (60 cm) thick over gray silt loam. Depth to the coarse substratum ranges from 20 inches (50 cm) to more than 48 inches (120 cm). The soils are nonacid or, in the Yukon Flats, calcareous. Many of the soils in the Yukon Flats apparently are perennially frozen at depths greater than 40 inches (1 m). Such soils, though not described separately here, are properly classified as Pergelic Cryochrepts. Some of these soils may have sufficient accumulation of clay in the brown horizon to make necessary a change in their classification, but not enough information is available at present to justify this revision. See *81b* in table 6.

Aeric Cryaquepts, loamy, nearly level, (20 percent) are moderately well drained soils formed in silty loess over a substratum of sand or very gravelly sand. They occur in slight depressions and former drainageways in terraces and outwash plains. The vegetation is dominantly black spruce forest. Typically, under a thin mat of coarse organic matter the soils have about 4 inches (10 cm) of dark brown silt loam over mottled brown silt loam to a depth of 20 to 48 inches (50 to 120 cm). The substratum is gray sand or very gravelly sand. See *58* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level, (10 percent) are poorly drained soils with a thick peaty surface mat and a shallow permafrost table. They occur in slight depressions and drainageways in the terraces. The vegetation in most areas is a forest of black spruce and willow and a ground cover of sphagnum moss. Typically, under a thick surface layer of moss and peaty material the soils have a few inches of black silt loam over mottled gray silt loam or gravelly silt loam. They are perennially frozen below 10 to 24 inches (25 to 60 cm). Perched water above the permafrost keeps the soils wet during the summer. See *65a* in table 6.

Other components (5 percent):

Typic Cryopsamments, sandy, nearly level to steep, are excessively drained soils in low dunes. They support a forest of white spruce, paper birch, and aspen. See *21* and *22* in table 6.

Typic Cryofluvents, loamy, nearly level, are well drained stratified soils on natural levees on flood plains along major streams. They support a forest of white spruce, paper birch, and cottonwood. See *7a* in table 6.

IR2—Typic Cryochrepts-Typic Cryorthents, loamy, nearly level to rolling association is in the following major land resource areas:

	Acres
174 Interior Alaska Lowlands	616,000
176 Interior Alaska Highlands	323,000
Total	939,000

This association occupies high nearly level to gently sloping terraces on the Yukon Flats and low rolling hills at the eastern border of the Flats. In most places the soils formed in a thick mantle of calcareous loess. Elevations range from 550 feet (170 m) on the terraces to about 1,600 feet (490 m) on a few high hills.

Most of the soils in this association are well drained and support a forest of aspen, paper birch, and white and black spruce. Many have permafrost at depths greater than 40 inches (1 m), but the relative extent of soils with permafrost and the thickness of the permafrost are not known. Along drainageways the soils are poorly drained and have shallow permafrost. They support a forest of willow and black spruce. Very poorly drained organic soils occur in a few depressions.

Well drained soils of this association are suitable for agriculture and commercial forestry. If it is possible, by clearing, to warm the soils sufficiently to thaw all ice-rich permafrost, there will be few limitations for most kinds of construction. If not, successful construction would depend on procedures developed for perennially frozen soils, and some installations, such as septic tanks, would be impractical.

Principal components:

Typic Cryochrepts, loamy, nearly level to rolling, (50 percent) are well drained soils on terraces and southerly slopes of low hills. They formed in thick calcareous loess. Most areas have been burned over in recent years and now support a forest dominated by young aspen and willow. Unburned areas are covered by white and black spruce, paper birch, and aspen.

Typically, these soils have a dark brown surface horizon underlain by a brown cambic horizon and gray calcareous silt loam to depths greater than 40 inches (1 m). On the hills, some angular sandstone fragments occur in the lower part of the soils. Permafrost, if present, is deeper than 40 inches (1 m). Soils with permafrost are properly classified as Pergelic Cryochrepts, but in these areas they have not been separately identified in mapping. See *81b* in table 6.

Typic Cryorthents, loamy, nearly level to rolling, (35 percent) are well drained loamy soils formed in dark grayish brown calcareous loess. They occur on nearly level to gently sloping terraces close to flood plains and on gentle to rolling northerly slopes of low hills. Most areas have been burned over in recent years and now support a stand of young aspen, paper birch, willows, and black spruce.

Typically, these soils have a thin dark brown surface layer over dark grayish brown silt loam with olive gray and olive brown streaks and patches. Permafrost, if present, is below a depth of 40 inches (1 m). Soils of this kind with permafrost are properly classified as Pergelic Cryorthents, but in these areas they have not been separately identified in mapping. See *10a* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (10 percent) are poorly drained soils in broad shallow drainageways and depressions. They have a thick peaty surface mat and a shallow permafrost table. The vegetation is a black spruce forest with a thick ground cover of low shrubs, mosses, and lichens.

Typically, under a thick surface mat of mosses and peaty material, the soils have a few inches of dark brown silt loam over dark gray mottled silt loam about 12 inches thick. Beneath this is olive gray calcareous silt loam that is perennially frozen. During the summer the soils are usually wet because of water perched above the permafrost. See *65a* in table 6.

Other components (5 percent):

Pergelic Cryaquepts, loamy, nearly level to rolling, are poorly drained silty soils with permafrost that occupy toe slopes on terraces and low hills. The vegetation is dominantly black spruce, white spruce, and paper birch. See *72a* in table 6.

Pergelic Cryohemists, nearly level, are very poorly drained organic soils in valley bottoms and shallow depressions, commonly adjoining lakes. The permafrost table is shallower than 2 feet (60 cm). The vegetation includes black spruce, sedges, mosses, and lichens. See *39* in table 6.

IR3—Typic Cryochrepts, loamy, nearly level to rolling-Typic Cryopsamments, sandy, hilly to steep association is in the following major land resource areas:

	Acres
174 Interior Alaska Lowlands	221,000
175 Kuskokwim Highlands	192,000
Total	413,000

This association occupies broad, choppy outwash plains in areas near the Kantishna and Tanana Rivers. The landscape is made up of nearly level terraces interrupted by many irregular hilly areas of elongated and crescent-shaped stabilized dunes. There are few lakes, streams, or muskegs. Nearly all of the association is covered with forests of quaking aspen and white spruce patterned by contrasting stands of different ages which are largely the result of repeated forest fires. Elevations over most of the areas are between 400 and 800 feet (120 and 240 m) above sea level.

Soils of the area formed in a mantle of silty loess over thick deposits of waterlaid and eolian fine sand. The silty loess cap is about 15 to 40 inches (40 to 100 cm) thick on most of the nearly level terraces, but it is commonly less than 10 inches (25 cm) thick on dunes.

Though the soils on nearly level and undulating terraces are suitable for crops, their potential for extensive cultivation is limited by the frequent occurrence of soils that are too hilly and droughty for most crops. The soil limitations for buildings, roads, and other types of construction are generally slight or moderate except on steep dunes. Largely because soil moisture is less than optimum during parts of the growing season, the potential for commercial forestry is probably marginal.

Principal components:

Typic Cryochrepts, loamy, nearly level to rolling, (35 percent) are well drained soils on nearly level and undulating terraces between stabilized dunes. They support forests of quaking aspen and white spruce. Typically, the soils have brown upper layers developed in 24 to 40 inches (60 to 100 cm) of silty loess over deep fine sand. See *81b* in table 6.

Typic Cryopsamments, sandy, hilly to steep, (30 percent) are excessively drained soils formed in a thin mantle of loess over deep fine sand. They occur on choppy stabilized dunes under forests of quaking aspen and white spruce. Typically, they have a brown surface

horizon developed in a mantle of silty loess less than 10 inches (25 cm) thick over fine sand. See *22* in table 6.

Typic Cryochrepts, sandy, hilly to steep, (15 percent) are well drained soils formed in 10 to 24 inches (25 to 60 cm) of silty loess over fine sand. They occur on low stabilized dunes under a forest of quaking aspen and white spruce. Typically, the soils have brown silt loam upper horizons grading to dark grayish brown or olive brown silt loam over fine sand. See *84* in table 6.

Typic Cryochrepts, sandy, nearly level to rolling, (10 percent) are well drained soils on undulating terraces between stabilized dunes. They support forests dominated by quaking aspen and white spruce. Typically, they have brown silt loam upper layers formed in 10 to 24 inches (25 to 60 cm) of silty loess over fine sand. See *83* in table 6.

Aeric Cryaquepts, loamy, nearly level to rolling, (10 percent) are moderately well drained soils in slight, nearly level depressions or swales in terraces. They support either forests of black spruce or stands of quaking aspen and white spruce. Typically, they have highly mottled grayish brown silt loam horizons and developed in 24 to 40 (60 to 100 cm) inches of silty loess over deep fine sand. See *58* in table 6.

IR4—Typic Cryochrepts-Histic Pergelic Cryaquepts, loamy, nearly level to rolling association is in the following major land resource areas:

	Acres
172 Copper River Plateau	83,000
174 Interior Alaska Lowlands	1,679,000
176 Interior Alaska Highlands	221,000
Total	1,983,000

This association occupies extensive areas of terraces and low hills bordering flood plains of the Yukon River and a smaller area in the lower part of the Copper River Valley. Though overall relief of the landscape is relatively smooth, the lower parts of terraces are commonly traversed by steep narrow valleys of deeply incised tributary rivers and streams. Elevations range from about 700 to 1,500 feet (200 to 450 m) above sea level and a high proportion of the association is forested.

The dominant soils formed in thick deposits of nonacid to calcareous silty loess blown from bordering flood plains during the post-glacial period. Under forests dominated by white spruce, paper birch, and quaking aspen, soils are generally well drained and free of permafrost in the upper 40 inches (100 cm). In poorly drained soils that commonly occur in nearly level depressions and on foot slopes, the permafrost table is shallow and the vegetation is either a forest of stunted black spruce or a tundra dominated by sedges, mosses, and low shrubs.

In general, the nearly level to rolling, well drained soils are suitable for cultivation and commercial forestry and have few or moderate limitations for most types of construction. The poorly drained soils with permafrost have severe limitations for most uses.

Principal components:

Typic Cryochrepts, loamy, nearly level to rolling, (50 percent) are deep, well drained soils on terraces and low rounded hills under forests dominated by white spruce, quaking aspen, and paper birch. Typically, the soils have brown upper layers over a thick deposit of gray or olive silty loess that is nonacid or calcareous. They are free of permafrost in the upper 40 inches (100 cm), but permafrost may occur at greater depth in some of the soils. See *81a* and *81b* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (30 percent) are poorly drained soils with a shallow permafrost table. They occur in valleys and in broad swales in terraces. The vegetation is stunted black spruce or a cover of sedges, mosses, and low shrubs. Typically, the soils have a peaty surface layer 8 to 16 inches (20 to 40 cm) thick over strongly mottled dark gray silt loam. The permafrost table is generally less than 20 inches (50 cm) beneath the organic mat. See *65a* in table 6.

Aeric Cryaquepts, loamy, nearly level to rolling, (10 percent) are moderately well drained soils on long foot slopes of low hills and in nearly level areas on terraces. The vegetation is normally a forest dominated by white spruce and paper birch, but in some areas it is mainly black spruce. Typically, beneath a thin mat of partially decomposed organic material, the soils consist of mottled dark grayish brown silt loam with patches and streaks of yellowish brown. Though the soils are free of permafrost in the upper 40 inches (100 cm), isolated masses of ice-rich frozen material may be buried in the substratum. See *58* in table 6.

Typic Cryorthents, loamy, nearly level to rolling, (10 percent) are deep well drained soils on terraces and low hills close to the flood plains. They support forests dominated by white spruce and quaking aspen. Typically, beneath a surface mat of forest litter, the soils consist of dark gray silt loam with patches and streaks of olive brown. The loamy material is usually many feet thick and is nonacid or calcareous. The soils are free of permafrost. See *10a* and *10b* in table 6.

IR5—Typic Cryochrepts-Entic Cryumbrepts, loamy, nearly level to rolling association is in the following major land resource area:

	Acres
172 Copper River Plateau	269,000

This association occupies low moraines, former lake basins, and terraces in areas close to the Copper River. Elevations range from about 1,000 to 2,000 feet (300 to 600 m) above sea level. Though much of the landscape is nearly level to rolling, a few steep narrow valleys of deeply incised streams are included.

The principal soils formed in a silty loess mantle of variable thickness over very gravelly drift on moraines and clayey lacustrine sediment in former lake basins and terraces. A thin layer of volcanic ash may occur at the surface. Soils under forests of white spruce, quaking aspen, and paper birch are well drained and free of permafrost. They are commonly interspersed with scattered areas of poorly drained soils that have a shallow permafrost table and are covered with either forests of stunted black spruce or tundra dominated by sedges, mosses, and low shrubs.

In general, most of the well drained soils are potentially suitable for forage crops and hardy vegetables but marginal for most crops because of the high probability of severe frosts during the growing season. Soil limitations for buildings and construction are slight or moderate for most of the well drained soils and severe for poorly drained soils with permafrost.

Though the well drained soils are capable of growing commercial timber, growth rates are low and the potential for commercial forestry is marginal.

Principal components:

Typic Cryochrepts, loamy, nearly level to rolling, (35 percent) are well drained soils without permafrost that occur on rolling moraine hills under forests of white spruce, quaking aspen, and paper birch. Typically, the soils have 24 to 40 inches (60 to 100 cm) of brown silt loam over very gravelly and stony glacial till. The upper part is commonly acid, but the lower part is nonacid or calcareous. See *81a* in table 6.

Entic Cryumbrepts, loamy, nearly level to rolling, (25 percent) are well drained soils in former lake basins and on high terraces under forests dominated by white spruce, paper birch, and aspen. Typically, they have a very dark brown, acid silt loam surface horizon over grayish brown to olive gray silt loam and a silty clay loam substratum. The substratum is nonacid or calcareous. See *95* in table 6.

Typic Cryoborolls, loamy, nearly level to rolling, (15 percent) are deep well drained soils on terraces and low moraines. The vegetation is a forest of white spruce, paper birch, and aspen, an understory of willow, and a ground cover of grasses. Typically, the soils have black or very dark brown nonacid silt loam upper layers over dark grayish brown silt loam that is calcareous in the lower part. See *104* in table 6.

Histic Pergelic Cryaquepts, clayey, nearly level to rolling, (15 percent) are poorly drained soils with a shallow permafrost table in nearly level depressions and swales in terraces. The vegetation is a forest of black spruce or tundra dominated by sedges, mosses, and low shrubs. Typically, beneath a peaty surface mat, 8 to 16 inches (20 to 40 cm) thick, the soils consist of mottled gray calcareous silty clay loam or clay loam. The permafrost table is commonly less than 16 inches (40 cm) below the mineral surface. See *64* in table 6.

Typic Cryorthents, clayey, nearly level to rolling, (5 percent) are well drained soils under forests of white spruce, quaking aspen, and paper birch on bluffs bordering the valleys of incised streams. Typically, the soils consist of gray silty clay loam or clay that is nonacid or calcareous. In places the clayey material is capped with a mantle of gray silt loam. See *9* in table. 6.

Pergelic Cryofibrists, nearly level, (5 percent) are very poorly drained areas of fibrous organic soils in scattered depressions under a cover of sedges, mosses, and low shrubs. The peat consists mainly of dark brown coarse sedge and moss fibers. Depth to permafrost is commonly less than 20 inches (50 cm). See *28* in table 6.

IR6—Typic Cryochrepts, loamy, hilly to steep-Histic Pergelic Cryaquepts, loamy, nearly level to rolling association is in the following major land resource areas:

		Acres
173	Alaska Range	65,000
174	Interior Alaska Lowlands	73,000
175	Kuskokwim Highlands	946,000
176	Interior Alaska Highlands	2,772,000
177	Norton Sound Highlands	431,000
	Total	4,287,000

This association occupies rounded hills with long foot slopes and broad intervening valleys near major streams in the interior. Elevations range from about 500 to 2,000 feet (150 to 600 m) above sea level. Except for high ridgetops and steep slopes, most of the hills and valleys are mantled with silty loess or colluvium. The dominant soils on southerly slopes are well drained and free of permafrost. They are covered by forests of white spruce, quaking aspen, and paper birch. Poorly drained soils with a shallow permafrost table occur on north-facing slopes and in valleys under a forest of stunted black spruce or a cover of sedges, mosses, and low shrubs. Moderately well drained soils with buried ice masses on some foot slopes support a forest of either white spruce and paper birch or black spruce.

The dominant soils are too steep, too cold, or too wet for cultivation and commercial forestry, but some of the well drained soils on gentle south-facing slopes are potentially suitable for crops and generally have the fewest soil limitations for construction and other intensive uses. The moderately well drained soils are suitable for crops, but are subject to pitting and uneven settlement after clearing.

Principal components:

Typic Cryochrepts, loamy, hilly to steep, (35 percent) are well drained soils without permafrost that occur on slopes other than north-facing and under forests of white spruce, paper birch, and aspen. Typically, they have brown upper layers over dark gray to olive silt loam 24 to more than 40 inches (60 to 100 cm) thick over partially weathered bedrock. See *82* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (25 percent) are poorly drained soils with a shallow permafrost table that occupy valleys and north-facing foot slopes. They have a thick mat of peaty material at the surface over mottled gray silt loam. The vegetation is either a forest of black spruce or tundra dominated by sedges, mosses, and low shrubs. See *65a* and *65b* in table 6.

Typic Cryochrepts, very gravelly, hilly to steep, (15 percent) are shallow, well drained soils without permafrost on the upper parts of hills and ridges under forests of white spruce, paper birch, and quaking aspen. Typically, they have brown upper layers formed in shallow silty loess over very gravelly material weathered from bedrock. See *86* in table 6.

Aeric Cryaquepts, loamy, nearly level to rolling, (10 percent) are moderately well drained soils on south-facing foot slopes under forests dominated by white spruce and paper birch. They formed in thick deposits of silty loess or colluvium commonly containing large masses of buried ice that may melt after clearing. Typically, beneath a thin mat of partially decomposed forest litter, the soils consist of mottled grayish brown and dark yellowish brown silt loam. See *58* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (5 percent) are shallow, poorly drained soils with permafrost that occur on steep north-facing slopes under either a forest of black spruce or a thick cover of mosses, sedges, and low shrubs. Typically, the soils have a thick peaty surface mat over mottled dark gray very gravelly silt loam weathered from bedrock. The permafrost table is commonly less than 10

inches (25 cm) below the peaty surface mat. See *69* in table 6.

Typic Cryorthents, loamy, hilly to steep, (5 percent) are deep, well drained soils without permafrost that occur on low bluffs and hills close to rivers under forests of white spruce, quaking aspen, and paper birch. Beneath a thin surface layer of partially decomposed organic material, the soils consist of dark gray silt loam streaked with patches of yellowish brown or brown. The silty material is generally many feet thick. See *11* in table 6.

Pergelic Cryofibrists, nearly level, (5 percent) are very poorly drained fibrous organic soils with a shallow permafrost table. They occur in scattered depressions under a cover of sedges, mosses, and low shrubs. Beneath a thick mat of live vegetation and roots, the peat consists mainly of dark brown partially decomposed sedge and moss fibers. The permafrost table is commonly less than 30 inches (75 cm) below the surface. See *28* in table 6.

IR7—Typic Cryochrepts-Histic Pergelic Cryaquepts, sandy, nearly level to rolling association is in the following major land resource areas:

	Acres
174 Interior Alaska Lowlands	243,000
176 Interior Alaska Highlands	200,000
177 Norton Sound Highlands	120,000
Total	563,000

This association occupies areas of low stabilized dunes bordering flood plains of the lower Koyukuk River Valley (fig. 33). Undulating to rolling forested lowlands, interrupted by irregular areas of wet tundra and a few lakes, make up the landscape. The elevation ranges from about 400 to 800 feet (120 to 240 m) above sea level. Most of the soils formed in a thin cap of silty loess over thick deposits of eolian sand. Well drained soils under forests of aspen and white spruce have no permafrost in the upper 40 inches, but poorly drained soils in depressions or muskegs generally have a shallow permafrost table.

Most of the well drained soils are potentially suitable for cultivation or forestry and have few or only moderate limitations for construction and buildings. The poorly drained soils with permafrost have severe limitations for any intensive use.

Principal components:

Typic Cryochrepts, sandy, nearly level to rolling, (35 percent) are well drained to excessively drained soils on low stabilized dunes under forests dominated by quaking aspen and white spruce. They formed in 10 to 30 inches (25 to 75 cm) of silty loess over deep fine sand. Typically, beneath a thin surface mat of forest litter, the soils have brown silt loam upper layers over olive gray fine sand. See *83* in table 6.

Histic Pergelic Cryaquepts, sandy, nearly level, (30 percent) are poorly drained soils with a shallow permafrost table that occupy broad depressions and swales between dunes. In swales and some depressions the soils are covered by stunted black spruce, but in broad depressions the dominant vegetation is sedges, mosses, and low tundra shrubs. Typically, the soils have a peaty surface layer 8 to 16 inches (20 to 40 cm) thick over mottled dark gray sandy loam or gray sand with thin lenses of silt loam. The permafrost table is generally less than 20 inches (50 cm) below the peaty surface layer. See *67* in table 6.

Typic Cryopsamments, sandy, hilly to steep, (25 percent) are excessively drained sandy soils on hilly dunes. They support forests of quaking aspen and a ground cover of short grasses and low shrubs. Typically, under a very thin cover of organic material the soils consist of grayish brown or olive brown sandy loam a few inches thick over deep grayish brown fine sand. See *22* in table 6.

Pergelic Cryofibrists, nearly level, (5 percent) consist of very poorly drained fibrous peat in scattered muskegs. The vegetation is dominantly sedges, mosses, and low shrubs. The peat consists mainly of dark brown coarse sedge and moss fibers perennially frozen below 10 to 20 inches (25 to 50 cm). See *28* in table 6.

Other components (5 percent):

Typic Cryorthods, sandy, nearly level to rolling, are well drained soils with thin albic and spodic horizons on scattered terraces near dunes. The vegetation is a forest of white spruce. See *122* in table 6.

Typic Cryofluvents, loamy, nearly level, are well drained stratified soils on low natural levees along a few included streams. The vegetation consists mainly of cottonwood, willow, and white spruce. See *7a* and *7c* in table 6.

IR8—Typic Cryochrepts, very gravelly, nearly level to rolling association is in the following major land resource area:

	Acres
174 Interior Alaska Lowlands	268,000

This association occurs on high terraces north of the Alaska Range. Elevations range from about 1,200 feet to 2,200 feet (370 to 670 m). The terraces are nearly level, but include some low undulating to rolling dune areas and a few shallow depressions. There are few streams. The vegetation is dominantly a forest of paper birch and aspen, with patches of black spruce in depressions.

The soils formed mostly in a thin mantle of loess over very gravelly glacial outwash or dune sand. Silty material has accumulated to greater thicknesses in depressions.

Soils of the association are suitable for forestry and construction sites. The deeper soils at elevations of 1,500 feet or less can be used for grain and vegetables, though the frost hazard is high. Other soils are suitable only for grass.

Principal components:

Typic Cryochrepts, very gravelly, nearly level to rolling, (90 percent) are well to excessively drained soils on nearly level to gently sloping high terraces. They formed in a thin layer of silty loess underlain by very gravelly sand. The vegetation is mostly a forest of aspen or paper birch.

Typically, under the forest litter, the soils have a thin layer of dark reddish brown silt loam and a somewhat thicker layer of dark brown silt loam underlain by olive very gravelly sand. The silty mantle is 5 to 20 inches (12 to 50 cm) thick. See *85b* in table 6.

Typic Cryopsamments, sandy, nearly level to rolling, (5 percent) are excessively drained soils on low undulating to rolling dunes on high terraces. They formed

Figure 33.—Typic Cryochrepts form in thin loess cover over stabilized sand dunes. Typic Cryopsamments occur where loess is absent. Sandy Histic Pergelic Cryaquepts occupy depressions. North of Galena.

in a thin mantle of loess over eolian sand under a cover of aspen, alder, grasses, and forbs. Typically, under a very thin mat of organic matter, the soils have less than 5 inches (12 cm) of dark brown silt loam over gray fine sand. See *21* in table 6.

Pergelic Cryaquepts, loamy, nearly level to rolling, (5 percent) are poorly drained soils in depressions in flood plains and terraces. They are commonly associated with dunes. The soils formed in silty material under a cover of black spruce, willows, alder, and mosses. Typically, under a thin mat of organic material, the soils have a thin layer of very dark grayish brown silt loam over mottled dark grayish brown silt loam. Permafrost is at a depth of about 30 inches (75 cm). See *72a* in table 6.

IR9—Typic Cryochrepts-Typic Cryorthents, very gravelly, nearly level to rolling association is in the following major land resource areas:

	Acres
169 South Central Alaska Mountains	14,000
172 Copper River Plateau	283,000
176 Interior Alaska Highlands	109,000
Total	406,000

This association occupies broad plains bordering the Chitina River, a few other streams tributary to the Copper River, and a stretch of the Chandalar River north of the Yukon Flats. Most of the areas are between 800 and 1,500 feet (240 to 450 m) above sea level. Nearly level forested terraces interrupted by low flood plains along the rivers dominate the landscape. Short, steep escarpments on terrace edges and a few rolling moraines are included.

The dominant soils are well drained and formed in silty loess over thick deposits of very gravelly outwash. Most of these soils are forested with quaking aspen, white spruce, and paper birch. Poorly drained soils with permafrost support forests of stunted black spruce or a cover of mosses, sedges, and low shrubs in valley bottoms and in broad swales in terraces. Also included are very poorly drained deep fibrous peat soils in scattered depressions under a cover of sedges and mosses.

Most of the soils of the association are thickly vegetated and provide habitat for moose, bear, caribou, small mammals, and birds. The dominant well drained

soils have few or only moderate limitations for buildings and most other types of construction, but their potential for cultivation and forestry is marginal, largely because of shallow depth to gravel. In addition, the possibility of frost during the growing season severely limits the choice of crops. Poorly drained soils of the association have severe limitations for all intensive uses.

Principal components:

Typic Cryochrepts, very gravelly, nearly level to rolling, (40 percent) are well drained soils on terraces and moraines commonly forested with quaking aspen, white spruce, and paper birch. Typically, the soils have brown upper layers developed in shallow silt loam over very gravelly sand. See *85a* and *85b* in table 6.

Typic Cryorthents, very gravelly, nearly level to rolling, (30 percent) are well drained soils that commonly occur on low terraces bordering flood plains. The vegetation is a forest of quaking aspen, white spruce, and paper birch and an understory of willow and dwarf birch. Typically, the soils consist of very shallow dark grayish brown silt loam or sandy loam over very gravelly sand. See *12a* and *12b* in table 6.

Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling, (15 percent) are poorly drained soils with a shallow permafrost table that occupy broad swales in terraces. The vegetation is either a forest of stunted black spruce and a thick ground cover of moss or a tundra dominated by sedges, mosses, and shrubs. Typically, beneath a thick peaty surface mat the soils consist of mottled dark gray shallow silt loam or sandy loam over very gravelly and stony loam. The permafrost table is usually less than 20 inches (50 cm) below the peaty surface mat. See *68* in table 6.

Pergelic Cryofibrists, nearly level, (10 percent) consist of very poorly drained fibrous peat in scattered depressions under a cover dominated by sedges and mosses. Beneath the vegetative mat, the peat consists mainly of dark brown coarse sedge and moss fibers. These soils are usually wet in the summer, and the permafrost table is less than 20 inches (50 cm) below the surface. See *28* in table 6.

Other components (5 percent):

Typic Cryorthents, loamy, nearly level to rolling, are well drained soils formed in thick deposits of windlaid fine sandy loam on a few bluffs near flood plains. The vegetation is a forest of white spruce, paper birch, and quaking aspen. See *10* in table 6.

Typic Cryofluvents, loamy, nearly level, are well drained soils formed in loamy sediment on low natural levees bordering major streams. They support forests of white spruce and cottonwood. See *7a* and *7b* in table 6.

IR10—Typic Cryochrepts, very gravelly, nearly level to rolling-Aeric Cryaquepts, loamy, nearly level to rolling association is in the following major land resource areas:

	Acres
172 Copper River Plateau	44,000
173 Alaska Range	84,000
174 Interior Alaska Lowlands	878,000
Total	1,006,000

This association occupies high terraces, outwash plains, and foot slopes in the Tanana Valley north of the Alaska Range and in a small area on the western foot slopes of the Wrangell Mountains. Nearly level to rolling forested plains interrupted by many irregular areas of wet tundra and muskegs dominate the landscape. A few hilly moraines, flood plains along a few major rivers and secondary streams, and several small lakes are included. Elevations in most areas are between 1,000 and 2,000 feet (300 to 600 m), but range from about 500 feet (150 m) on flood plains near the Tanana River to 3,000 feet (900 m) on a few mountain foot slopes.

In general, the dominant soils are on terraces and outwash plains under forests of white spruce, paper birch, and quaking aspen. They are well drained and formed in a shallow mantle of silty micaceous loess over very gravelly and sandy alluvial deposits. Moderately well drained soils formed in a thick mantle of loess are also common on terraces and outwash plains under forests of white spruce and paper birch or nearly solid stands of black spruce. Soils in broad depressions, drainageways, and seepage areas on long foot slopes, under a cover of sedges, mosses, and low shrubs or under forests of stunted black spruce, are commonly poorly drained and have a shallow permafrost table.

The dominant well drained and moderately well drained soils are potentially suitable for cultivation or forestry and have few limitations for intensive uses. Small grains, grasses, and hardy vegetables are grown on these soils in a farming area near Delta Junction and on a few farms in other accessible areas. Soils with permafrost and very shallow soils have severe limitations for construction and are not generally suitable for farming.

Principal components:

Typic Cryochrepts, very gravelly, nearly level to rolling, (35 percent) are well drained soils on terraces, outwash plains, and low moraines and are commonly forested with stands of white spruce, paper birch, and aspen. Large areas, however, have been burned by forest fires and some areas near Delta Junction have been cleared for farming. Typically, the soils have dark brown to brown silt loam upper layers formed in 10 to 24 inches (25 to 60 cm) of micaceous loess over thick deposits of very gravelly sand. See *85a* in table 6.

Aeric Cryaquepts, loamy, nearly level to rolling, (25 percent) are moderately well drained soils in nearly level areas on terraces and outwash plains. They commonly formed in a mantle of micaceous silty loess 24 to 60 inches (60 to 150 cm) thick over gravel and sand. Though the vegetation is commonly a forest dominated by white spruce and paper birch, many areas support stands of black spruce and a ground cover of moss. Typically, beneath a partially decomposed mat of forest litter and roots, the soils have mottled dark grayish brown to dark yellowish brown silt loam upper layers over olive gray silt loam. The substratum consists of loose very gravelly sand. See *58* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (20 percent) are poorly drained soils with a shallow permafrost table that occupy irregular depressions in terraces and seepage areas on foot slopes. Though the vegetation is commonly a cover of sedge tussocks, mosses, and low shrubs, some areas support

forests of stunted black spruce. Typically, the soils have a thick peaty surface mat over mottled gray or dark gray silt loam. Depth to ice-rich permafrost is generally less than 20 inches (50 cm) below the organic surface layer. See *65a* in table 6.

Pergelic Cryaquepts, loamy, nearly level to rolling, (5 percent) are somewhat poorly drained soils with permafrost that occur on low terraces near flood plains. They formed in thick deposits of loamy waterlaid sediment and commonly support forests dominated by black spruce. In a typical profile, they have a thin peaty surface mat over mottled dark grayish brown or dark gray silt loam that contains thin strata of fine sand. In undisturbed areas, the permafrost table is 20 to 40 inches (50 to 100 cm) below the surface, but in places where the vegetation has been removed or destroyed the soils thaw to greater depths. See *72a* and *72b* in table 6.

Typic Cryopsamments, sandy, nearly level to rolling, (5 percent) are excessively drained soils on scattered low stabilized dunes under forests dominated by aspen, white spruce, and paper birch. Typically, they have a thin brown surface horizon developed in a few inches of silty loess over gray eolian fine sand. See *21* in table 6.

Other components (10 percent):

Pergelic Cryohemists, nearly level, are very poorly drained, partially decomposed organic soils in scattered depressions under a cover of grasses and sedges. They have a shallow permafrost table. See *39* in table 6.

Pergelic Cryofibrists, nearly level, are very poorly drained, coarse fibrous peat soils in depressions under a cover of mosses and sedges. They have a shallow permafrost table. See *28* in table 6.

Typic Cryochrepts, loamy, nearly level to rolling, are deep well drained silty soils on terraces under forests of white spruce, paper birch, and aspen. See *81a* and *81b* in table 6.

IR11—Typic Cryochrepts, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
169 South Central Alaska Mountains	315,000
172 Copper River Plateau	398,000
173 Alaska Range	91,000
174 Interior Alaska Lowlands	36,000
Total	840,000

This association occupies moraines and mountain foothills bordering the Tanana, Copper, and Chitina Valleys. Except for a few included flood plains and valleys, the landscape is made up of hills and ridges ranging from about 1,000 to 3,000 feet (300 to 900 m) above sea level.

Most of the soils in this association formed in thick deposits of very gravelly till and colluvium, but a few soils on steep ridges and peaks are shallow over bedrock. The dominant soils are well drained without permafrost and are forested with white spruce, paper birch, and aspen. They occur on nearly all slopes below tree line except those facing directly north. Poorly drained soils with permafrost occur in valleys and on steep north-facing slopes. They are under either a forest of stunted black spruce or a cover of mosses, sedges, and low shrubs. On high hills and ridges above 2,000 feet (600 m), the dominant vegetation is low alpine shrubs, mosses, lichens, and grasses.

Except for a few small areas in valleys and on low moraines, soils of the association are not potentially suitable for cultivation or forestry and have severe limitations for construction because of steep slopes. Primarily, the soils provide habitat for wildlife.

Principal components:

Typic Cryochrepts, very gravelly, hilly to steep, (65 percent) are well drained soils without permafrost on moraines and steep south-facing slopes below tree line. They support forests dominated by white spruce, paper birch, and aspen. Typically, beneath a thin mat of moss and forest litter, the soils have brown gravelly silt loam upper layers over a substratum of very gravelly loam or sandy loam. On steep slopes of high foothills the soils may be only 20 to 40 inches (50 to 100 cm) deep over bedrock. See *86* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (10 percent) are poorly drained soils with a shallow permafrost table on steep north-facing slopes, valley bottoms, and seepage areas on foot slopes. The vegetation is dominated by mosses, sedges, low shrubs, and scattered stands of stunted black spruce. Typically, the soils have a thick peaty surface mat over mottled dark gray very gravelly and stony silt loam or sandy loam. The permafrost table is usually less than 20 inches (50 cm) below the surface mat. See *69* in table 6.

Pergelic Cryochrepts, very gravelly, hilly to steep, (10 percent) are shallow well drained soils on ridgetops and hills above tree line. The vegetation is mainly mosses, grasses, forbs, and low alpine shrubs. Typically, the soils have a brown gravelly silt loam surface horizon over very gravelly loam or sandy loam. Bedrock is commonly 20 to 40 inches (50 to 100 cm) below the surface. Though the mean annual soil temperature is below freezing, there is seldom enough moisture in the very gravelly material to form solid ice. See *93* in table 6.

Lithic Cryochrepts, very gravelly, hilly to steep, (5 percent) are well drained to excessively drained soils that are shallow over bedrock. They occur on steep south-facing slopes. The vegetation is commonly a forest dominated by quaking aspen and white spruce. Typically, the soils have brown upper layers and a gray substratum. They formed in very gravelly and stony silt loam or sandy loam less than 20 inches (50 cm) thick over bedrock. See *92a* in table 6.

Other components (10 percent):

Typic Cryochrepts, loamy, nearly level to rolling, are moderately deep, well drained loamy soils on low moraines and foot slopes. The vegetation is a forest of white spruce, quaking aspen, and paper birch. See *81a* and *81b* in table 6.

Typic Cryorthents, loamy, nearly level to rolling, are deep, well drained loamy soils on a few bluffs near flood plains. The vegetation is a forest of white spruce, aspen, and paper birch. See *10a* and *10b* in table 6.

Typic Cryofluvents, loamy, nearly level, are well drained soils formed in sandy and silty sediment on natural levees along streams. The vegetation is domin-

antly cottonwood, white spruce, willow, alder, and grass. See *7a, 7b,* and *7c* in table 6.

Pergelic Cryofibrists, nearly level, are very poorly drained organic soils with permafrost. They occur in scattered depressions in moraines under a cover of sedges and mosses. See *28* in table 6.

IR12—Typic Cryochrepts, very gravelly, hilly to steep-Histic Pergelic Cryaquepts, loamy, nearly level to rolling association is in the following major land resource areas:

	Acres
173 Alaska Range	672,000
174 Interior Alaska Lowlands	33,000
175 Kuskokwim Highlands	1,533,000
176 Interior Alaska Highlands	12,023,000
Total	14,261,000

This association is extensive on hilly uplands in the central and eastern parts of interior Alaska (fig. 34). High rounded ridges and hills separated by broad moderately sloping valleys dominate the landscape, but most areas include a few mountain peaks, deep narrow valleys, and small flood plains. Elevations generally range from 1,000 to 3,500 feet (300 to 1,050 m) above sea level, but exceed 4,500 feet (1,350 m) on a few peaks.

Soils of the association formed in a variety of parent material. The dominant soils on the hills consist of very gravelly or stony material weathered from local rock. In broad valleys the principal soils formed in deep loamy sediment washed from the surrounding uplands. In places near large flood plains the hills and valleys are commonly mantled with silty loess. In the eastern parts of the association they are capped with a thin deposit of volcanic ash. In a few glaciated areas near the Alaska Range the soils formed in very gravelly glacial drift.

There are several principal types of vegetation in the association. On well drained soils without permafrost that occur on southerly slopes below the 2,000 to 2,500 foot (600 to 750 m) level are forests dominated by white spruce, quaking aspen, and paper birch. On slopes and ridgetops at higher levels the soils are covered with alpine shrubs, grasses, lichens, mosses, and forbs. On steep north-facing slopes and in valleys on poorly drained soils with a shallow permafrost table, the

***Figure 34.*—Typic Cryochrepts occupy most hillsides, under a mixed forest. Many areas are burned over. Histic Pergelic Cryaquepts occur in valley bottoms, on lower slopes, and on steep north-facing slopes, mostly under black spruce forest. Aquic Cryorthents, with black spruce or shrubby vegetation, occur on ridges. North of Chatanika.**

vegetation is mainly mosses, sedge tussocks, and low shrubs or forests of stunted black spruce.

The dominant soils of the association are not suitable for cultivation and have severe limitations for construction. Some areas on nearly level to moderate slopes at lower elevations, however, are suitable for small grains, forage crops, and hardy vegetables and have few or only moderate limitations for construction. Most of the well drained and moderately well drained soils under forests of white spruce, paper birch, and aspen are capable of producing commercial timber.

Principal components:

Typic Cryochrepts, very gravelly, hilly to steep, (30 percent) are well drained soils without permafrost on south-facing slopes under forests of white spruce, paper birch, and quaking aspen. Most of these soils formed in very gravelly and stony material derived from local bedrock, but a few that occur on moraines formed in very gravelly drift. In places near large flood plains the gravelly material is capped with a thin layer of silty loess. In eastern areas of the association the soils are mantled with a thin deposit of volcanic ash. Typically, the soils have brown silt loam or gravelly silt loam upper layers over olive brown very gravelly and stony silt loam or sandy loam. The unconsolidated material commonly contains appreciable quantities of mica. In places on steep slopes, the soils are only 20 to 40 inches (50 to 100 cm) deep over bedrock. See *86* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (25 percent) are poorly drained soils with a shallow permafrost table on long foot slopes and valley bottoms. The vegetation is mainly sedge tussocks, mosses, low shrubs, and scattered stands of stunted black spruce. Typically, the soils have a peaty surface mat 8 to 16 inches (20 to 40 cm) thick over mottled, dark gray frost-churned silt loam that contains black streaks of buried organic material. The permafrost table is usually 10 to 20 inches (25 to 50 cm) below the peaty surface. See *65a* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (10 percent) are poorly drained soils with a shallow permafrost table on steep north-facing slopes under a cover of mosses, sedges, low shrubs, and stunted black spruce. Typically, they have a thick peaty surface mat over mottled dark gray, very gravelly and stony micaceous silt loam. The permafrost table is usually less than 10 inches (25 cm) below the surface mat. On the upper slopes of steep hillsides, the unconsolidated material is commonly only 20 to 40 inches (50 to 100 cm) thick over bedrock. See *69* in table 6.

Aquic Cryorthents, very gravelly, hilly to steep, (10 percent) are moderately well drained to somewhat poorly drained soils on hills and ridges near tree line. The vegetation is mainly tall shrubs and stunted black spruce. Beneath a thin mat of peaty organic material, the soils consist of mottled dark grayish brown and olive brown very gravelly silt loam or sandy loam. In places, bedrock is 20 to 40 inches (50 to 100 cm) below the surface. See *15* in table 6.

Other components (25 percent) :

Pergelic Cryorthents, very gravelly, hilly to steep, are well drained soils on ridges above tree line. The vegetation is alpine tundra. The mean annual soil temperature is below freezing. See *20* in table 6.

Pergelic Cryochrepts, very gravelly, hilly to steep, are well drained soils on the tops of high hills and ridges under a cover of alpine tundra. Mean annual soil temperature is below freezing. In places, the soils are moderately deep over bedrock. See *93* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, are well drained soils on hills and ridges under alpine tundra vegetation. The mean annual soil temperature is below freezing. The soils are generally moderately deep over bedrock. See *100* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, are well drained soils with thin albic and spodic horizons on high hills and ridges. The vegetation is mainly low shrubs, mosses, lichens, and grasses. The mean annual soil temperature is below freezing. See *137* in table 6.

Pergelic Cryaquepts, very gravelly, nearly level to rolling, are poorly drained soils with shallow permafrost tables in swales and valleys on broad ridges above tree line. The vegetation is mainly low shrubs, mosses, and sedges. See *75* in table 6.

Aeric Cryaquepts, loamy, nearly level to rolling, are moderately well drained, deep silty soils on foot slopes under forests of white spruce, paper birch, and black spruce. They are underlain by scattered masses of buried ice. See *58* in table 6.

Typic Cryofluvents, loamy, nearly level, are well drained soils formed in sediment on natural levees bordering streams. They are commonly forested with white spruce or cottonwood and large patches of willow brush. See *7a* and *7c* in table 6.

Rough mountainous land includes areas of bare rockslides on high peaks. It supports little or no vegetation. See *145* in table 6.

Andic Cryochrepts, very gravelly, hilly to steep, are well drained soils on low hills in eastern areas of the association under forests of white spruce, paper birch, and aspen. The upper part of the soils consists of 7 to 12 inches (18 to 30 cm) of silty or sandy volcanic ash. See *90* in table 6.

Dystric Cryochrepts, very gravelly, hilly to steep, are well drained soils on hills of granitic rock. The vegetation is a forest of white spruce, paper birch, and aspen. See *91* in table 6.

Typic Cryorthents, very gravelly, hilly to steep, are well drained soils on steep hillsides in close association with very gravelly Typic Cryochrepts. They consist entirely of dark grayish brown very gravelly silt loam. The vegetation is a forest of white spruce, paper birch, and aspen. See *13c* in table 6.

Pergelic Cryaquepts, loamy, hilly to steep, are somewhat poorly drained soils with a fairly thick mantle of volcanic ash. They occur on foot slopes only in the extreme east-central part of Alaska. The vegetation is white spruce, black spruce, paper birch, and willows. See *73* in table 6.

IR13—Typic Cryochrepts-Histic Pergelic Cryaquepts, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
173 Alaska Range	58,000
174 Interior Alaska Lowlands	134,000
175 Kuskokwim Highlands	54,000
176 Interior Alaska Highlands	1,805,000
177 Norton Sound Highlands	585,000
Total	2,636,000

The major areas of this association occupy high hills and ridges between the Yukon River and the Brooks Range (fig. 35). Several smaller areas occupy scattered hills in the Tanana Valley. Elevations in most areas are between 1,000 and 2,500 feet (300 and 750 m) above sea level, but a few higher peaks are included. A high proportion of the landscape is made up of steep hillsides and foot slopes that are forested with white spruce, quaking aspen, and paper birch on south-facing slopes and stunted black spruce or mossy tundra on north-facing slopes. High ridgetops with a cover of alpine tundra plants and a few low valleys with sedge tussocks are included.

The dominant soils in the association formed in very gravelly and stony colluvial or residual material derived from local rock. A few soils on moraine hills and in valleys near the mountains formed in very gravelly glacial drift. Though the mean annual air temperature in areas of the association is below freezing, the soils on south-facing slopes under white spruce-paper birch-aspen forests are generally free of permafrost in the upper 40 inches (100 cm).

Though hardy vegetables are grown in small home gardens at lower elevations, soils of the association are not potentially suitable for extensive cultivation. Most of these soils have severe limitations for construction. The well drained soils are capable of producing trees of commercial size.

Principal components:

Typic Cryochrepts, very gravelly, hilly to steep, (45 percent) are well drained soils on south-facing hillsides and foot slopes under forests dominated by white spruce, paper birch, and quaking aspen. Most of these soils formed in very gravelly colluvium or residual material, but a few on foot slopes and moraines near the mountains formed in very gravelly drift. In places at lower elevations, the coarse material is capped with thin deposits of silty loess. Typically, beneath a thin mat of partially decomposed organic material and roots, the soils have a brown gravelly silt loam surface layer and an olive brown very gravelly silt loam subsurface layer. On the steeper slopes, they are commonly 20 to 40 inches (50 to 100 cm) thick over bedrock. See *86* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (30 percent) are poorly drained soils with a shallow permafrost table on steep northerly slopes and valley bottoms. The vegetation is mainly sedges, mosses, low shrubs, and stunted black spruce. In a typical profile, the soil has 8 to 16 inches (20 to 40 cm) of peaty organic material over mottled dark gray

***Figure 35.*—Typic Cryochrepts occupy southerly slopes, under mixed forest. Histic Pergelic Cryaquepts under mosses, sedges, and black spruce are on north-facing slopes, on foot slopes, and in narrow valley bottoms. Pergelic Cryochrepts and Pergelic Cryorthods are the principal soils of ridges above tree line. West of Bettles.**

very gravelly and stony silt loam. The permafrost table is commonly less than 10 inches (25 cm) below the organic mat. See *69* in table 6.

Lithic Cryochrepts, very gravelly, hilly to steep, (10 percent) are shallow, well drained soils on the upper parts of steep hillsides under forests dominated by white spruce, paper birch, and quaking aspen. Typically, they have a brown surface layer developed in very gravelly and stony silt loam or sandy loam less than 20 inches (50 cm) thick over bedrock. See *92a* in table 6.

Other components (15 percent):

Pergelic Cryorthods, very gravelly, hilly to steep, are well drained soils with thin albic and spodic horizons on high ridgetops above tree line. The vegetation is alpine tundra. See *137* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, are poorly drained soils with a shallow permafrost table on low foot slopes and in broad valleys. The vegetation is mainly sedge tussocks, mosses, low shrubs, and scattered stands of black spruce. See *65a* and *65b* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, are poorly drained soils with permafrost in steep drainageways and swales in high broad ridgetops. The vegetation is mainly sedges, mosses, and low shrubs. See *76* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, are well drained soils with dark surface horizons on ridgetops above tree line. The vegetation is alpine shrubs, grasses, and forbs. See *100* in table 6.

Rough mountainous land consists of rockslides and exposed bedrock on sharp peaks. It supports little or no vegetation other than lichens. See *145* in table 6.

IR14—Alfic Cryochrepts, loamy, hilly to steep-Histic Pergelic Cryaquepts, loamy, nearly level to rolling association is in the following major land resource area:

	Acres
176 Interior Alaska Highlands	2,157,000

This association occupies hills north of the Tanana Valley at the southern edge of the Yukon-Tanana Upland (fig. 36). Elevations range from less than 500 feet (150 m) at the Tanana River flood plain west of Fairbanks to more than 2,000 feet (600 m) on the highest ridges. The hills are maturely dissected and are separated by fairly broad valleys and many small tributary valleys. In general, the valley sides are convex. Gentle lower slopes and steep upper slopes culminate in narrow ridgetops.

The bedrock in most of the area is a mica schist which has never been glaciated. The upper part of the schist is not consolidated but consists of angular rock fragments with highly weathered surfaces. The entire area is covered with micaceous loess blown from the broad beds of the Tanana River and its southern tributaries during and shortly after the height of glaciation in the Alaska Range. The loess is many feet thick over the shattered bedrock on lower slopes close to the flood plain but thins with distance from the river and with elevation. On some high ridges the loess is thinner than 10 inches (25 cm). Although the Tanana River and its southern tributaries still carry a large load of glacial silt, substantial loess depositions now occur only in a few places close to the rivers and do not affect soils over most of the area.

On most hillsides some of the loess has accumulated on foot slopes, in places over parts of a former flood plain. Much of the silty material has also been washed into the larger valley bottoms, where it is many feet thick over older alluvial deposits.

Except in small drainageways, soils on slopes with aspects other than north are well drained and support a forest of white spruce, paper birch, and quaking aspen. Soils on the foot slopes are moderately well drained and support either a white spruce-paper birch or a black spruce forest. On north-facing slopes the soils are poorly drained and generally are covered with a scrubby black spruce forest or low shrubs, sedges, and mosses. In a few places at lower elevations and in areas which have burned severely, the principal tree on the north-facing slopes is paper birch. Most of the soils in valley bottoms are poorly drained and support a black spruce forest. Nearly all of the poorly drained soils are underlain by permafrost.

Well drained and moderately well drained soils with gentle and moderate gradients on the lower parts of hillsides are suitable for all crops that can be grown in interior Alaska and for commercial forestry, but many are subject to gullying unless preventive measures are taken. The well drained soils in thick loess on lower slopes have moderate limitations for construction. The moderately well drained soils of foot slopes are subject to pitting and uneven settlement when cleared. The poorly drained soils with permafrost and the steep well drained soils have severe limitations for both cultivation and construction.

Principal components:

Alfic Cryochrepts, loamy, hilly to steep, (30 percent) occupy mostly mid slopes of hills with aspects other than north, where the thickness of the loess over shattered bedrock is at least 20 inches (50 cm). In some areas close to the rivers the loess is many feet thick. The soils are well drained and support forests of white spruce, paper birch, and quaking aspen, either as pure stands or as mixtures of two or three of these species.

The soils under a thin mat of forest litter commonly have a thin dark brown upper horizon, a brown or grayish brown second horizon, and, beginning at a depth of 6 or 8 inches (15 or 20 cm), a dark brown or dark yellowish brown horizon that extends to depths of 18 to 24 inches (45 to 60 cm). This third horizon contains very thin bands of fine silty or clayey material that has apparently been removed from the upper horizons and redeposited by water percolating through the soil. The silty loess below the brown soil is generally olive or olive gray and may be streaked with brown. The underlying weathered bedrock also generally has olive colors. See *88* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (20 percent) are poorly drained soils that occupy the bottoms of principal valleys and narrow drainageways of lower hillsides and the lower slopes of north-facing hillsides. They have a relatively thick surface mat of moss peat. Between this mat and the permafrost table, which ranges in depth from 5 to 30

Figure 36.—Alfic Cryochrepts occur on most hillsides under a forest of white spruce, paper birch, and quaking aspen. Histic Pergelic Cryaquepts occupy lowlands and north-facing slopes under sedges, mosses, and black spruce. Forested Aeric Cryaquepts are dominant on foot slopes and on low knolls in lowlands. West of Fairbanks.

inches (8 to 75 cm) depending on the thickness of the organic mat, the soil is mottled gray or greenish gray and is usually saturated. The vegetation is normally black spruce forest, but in many places it consists mostly of mosses, sedges, and low shrubs. See *65a* in table 6.

Alfic Cryochrepts, very gravelly, hilly to steep, (15 percent) are on higher parts of slopes with aspects other than north and on high ridges distant from the Tanana River flood plain where the loess is less than 20 inches (50 cm) thick over shattered bedrock. Soil characteristics and vegetation are essentially the same as in areas of thicker loess, but the material below the brown soil is weathered rock rather than loess and consists largely of angular rock fragments. See *89* in table 6.

Alfic Cryochrepts, loamy, nearly level to rolling, (10 percent) occur on the lower parts of slopes with aspects other than north and on low ridgetops close to the Tanana flood plain. Except for slope and, normally, greater thickness of loess, soil characteristics are the same as those of loamy Alfic Cryochrepts on hilly to steep land. See *87* in table 6.

Aeric Cryaquepts, loamy, nearly level to rolling, (15 percent) occupy foot slopes of hillsides on which Alfic Cryochrepts are dominant and also occur on isolated low hills in broad lowlands and in swales and draws in the hillsides. They receive substantial quantities of seep water early in summer and are only moderately well drained. They consist of deep dark grayish brown silt loam with brown mottles and streaks. The vegetation is a forest of either white spruce and paper birch or black spruce.

In many places large masses of ice underlie the soils at depths of 6 feet (180 cm) or more. Removal of the natural vegetation commonly results in warming of the soil and melting of the buried ice. Steep-walled pits or a polygonal pattern form on the surface as the soils settle. See *58* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to

steep, (5 percent) are on upper slopes of north-facing hillsides. They are normally steep and have only a shallow loess mantle over shattered bedrock. The soils have a thick surface mat of sphagnum moss peat and a very shallow permafrost table. Both the thin unfrozen layer and the frozen loess beneath it are gray and mottled. The underlying material, also frozen, is grayish brown or olive and consists mostly of angular rock fragments. The vegetation is a sparse black spruce forest or is dominated by a low shrubby growth. Some areas in which the mossy surface mat has been burned support forests of paper birch. See *69* in table 6.

Other components (5 percent):

Aquic Cryorthents, very gravelly, hilly to steep, are shallow, moderately well drained, olive brown soils on hills and ridges near tree line. The vegetation is black spruce and tall shrubs. See *15* in table 6.

Typic Cryopsamments, sandy, hilly to steep, are excessively drained sandy soils on stabilized dunes near flood plains. The vegetation is a forest of white spruce, paper birch, and aspen. See *22* in table 6.

Pergelic Cryofibrists, nearly level, are very poorly drained fibrous organic soils in depressions in valley bottoms under a cover of mosses, sedges, and low shrubs or black spruce. They have a shallow permafrost table. See *28* in table 6.

IU1—Pergelic Cryumbrepts, very gravelly, nearly level to rolling-Histic Pergelic Cryaquepts, loamy, nearly level to rolling association is in the following major land resource area:

	Acres
175 Kuskokwim Highlands	1,033,000

This association occupies broad valleys in areas east of Kuskokwim Bay. Elevations range from sea level along the coast to about 1,500 feet (450 m) in high valleys. A few mountain peaks higher than 3,300 feet (1,000 m) are included. The region exhibits features typical of recently glaciated valleys, including moraines, gravelly outwash terraces, and many small lakes and streams. Low mounds, frost scars, solifluction lobes, and other frost features are common.

Dwarf birch and other shrubs, forbs, grasses, and lichens cover rolling moraines and high terraces. Sedge tussocks, mosses, and low shrubs and forbs are dominant in depressions in the moraines, on toe slopes, and in drainageways. Willows and grasses are the principal plants on broad flood plains and low terraces.

Most soils formed in a thin layer of loess or volcanic ash over very gravelly glacial till or outwash. Organic soils occupy the depressions. Permafrost underlies most of the area.

This association is too cold for cultivated crops. Well drained soils on the rolling moraines and terraces are suitable for most construction, but poorly drained soils with permafrost have severe limitations for this purpose. The vegetation provides wildlife habitat for caribou, moose, bear, some small mammals, and migratory birds. It is suitable as reindeer range.

Principal components:

Pergelic Cryumbrepts, very gravelly, nearly level to rolling, (50 percent) are well drained soils on rolling moraines and high terraces of broad valleys. The vegetation is low shrubs, forbs, and lichens. Under a thin mat of well decomposed organic matter, the soils consist of dark brown very gravelly loam that grades with depth to brown or grayish brown. In most places they have a thin layer of loess or volcanic ash at the surface. They are typically extremely acid. Areas with frost boils and low mounds commonly have a loamy upper horizon with slightly thixotropic properties. Mean annual soil temperatures are below freezing, but ice-rich permafrost, if present, is many feet deep. See *99* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (30 percent) are poorly drained soils that occupy nearly level valley bottoms, low terraces, and gently sloping valley sides. They support a cover of sedge tussocks, mosses, and low shrubs and forbs. The soils consist of a surface mat of peaty organic matter over very dark gray mucky silt loam underlain by mottled dark gray silt loam. The permafrost table is usually just under the organic mat but may be as deep as 24 inches (60 cm). See *65a* in table 6.

Pergelic Cryofibrists, nearly level, (10 percent) are very poorly drained organic soils in depressions in moraines and in drainageways. They support a dense cover that consists dominantly of sedges and mosses. The soils are made up of fibrous moss peat and intervening layers of partly decomposed sedge peat. Permafrost is generally at a depth of less than 16 inches (40 cm). The soils are strongly acid. See *28* in table 6.

Other components (10 percent):

Typic Cryofluvents, very gravelly, nearly level, are well drained soils developed in stratified sand and silt loam over a shallow substratum of very gravelly sand. They occupy natural levees on flood plains. They support willows, shrubs, and grasses. See *8c* in table 6.

Pergelic Cryaquepts, very gravelly, nearly level to rolling, are poorly drained soils formed in glacial till on foot slopes of moraine hills and valley sides. The vegetation is dominated by shrubs and sedges. See *75* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, are well drained soils formed in glacial till on hilly moraines. They support low shrubs, forbs, and lichens. See *100* in table 6.

IU2—Pergelic Cryumbrepts-Histic Pergelic Cryaquepts, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
169 South Central Alaska Mountains	45,000
172 Copper River Plateau	668,000
175 Kuskokwim Highlands	707,000
176 Interior Alaska Highlands	370,000
177 Norton Sound Highlands	7,842,000
178 Western Alaska Coastal Plains and Deltas	130,000
179 Bering Sea Islands	250,000
181 Arctic Foothills	174,000
Total	10,186,000

This association occupies high hills and low mountains mostly in western Alaska but also on the Copper River Plateau and surrounding mountains.

In the SOUTH CENTRAL ALASKA MOUNTAINS and on the COPPER RIVER PLATEAU the association occupies glacially carved mountain valleys, moraine foot slopes, and hills. A few sharp peaks and ridges with bedrock

exposures are included. Elevations range from about 3,000 to 5,600 feet (900 to 1,700 m).

The entire area is above tree line except for patches of stunted black spruce in some valleys. The vegetation is mostly willow, alder, dwarf birch, and other shrubs. At lower elevations the shrubs are as much as 6 feet (180 cm) tall, but at the highest elevations the vegetation is only a few inches high. Poorly drained areas in valleys and on toe slopes and north-facing slopes are covered principally by sedge tussocks and mosses. Some steep foot slopes have a cover of grasses, alder, and associated shrubs and forbs.

No agriculture or forestry is possible in these areas. The vegetation is useful principally as habitat for a number of wildlife species, including moose and caribou. It is suitable as reindeer range. Steep slopes and permafrost are severe limitations for most kinds of construction.

Principal components in the South Central Alaska Mountains and on the Copper River Plateau:

Pergelic Cryumbrepts, very gravelly, hilly to steep, (45 percent) are well drained soils on upper slopes of high hills and ridges. They formed in very gravelly glacial till or, at the highest points, in weathered or shattered residual material in association with small areas of bedrock outcrop. The vegetation is dominantly low shrubs and forbs, mosses, and lichens. On some steep slopes the cover is dominantly grasses and shrubs.

The soils have a very dark brown or dark gray upper horizon over a brown or olive subsoil. The texture is generally very gravelly loam or silt loam, but some soils have a thin layer of windlaid silt loam at the surface. Ice-rich permafrost, if present, is many feet deep. See *100* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (25 percent) are poorly drained soils on lower hillsides and steep north-facing slopes. They formed in glacial till or colluvial deposits under a cover of sedges, mosses, and low shrubs. The soils have a thick peaty surface mat of organic matter underlain by gray very gravelly loam or sandy loam. Ice-rich permafrost is at a shallow depth. See *69* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, (15 percent) are well drained soils mostly on south-facing slopes of hills and ridges. They formed in very gravelly glacial till, in many places with a thin mantle of silty windlaid material. The vegetation is shrubs, forbs, mosses, and lichens. These soils have thin albic and spodic horizons over very gravelly loam or sandy loam. Ice-rich permafrost, if present, is at a great depth. See *137* in table 6.

Pergelic Cryochrepts, very gravelly, hilly to steep, (10 percent) are well drained soils on moraines and steep slopes of ridges, under low shrubs, forbs, grasses, mosses, and lichens. Typically, the soils have a thin upper horizon of very dark brown silt loam over dark yellowish brown gravelly silt loam and olive very gravelly sandy loam or loam. Ice-rich permafrost, if present, is at a great depth. See *93* in table 6.

Other components (5 percent):

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, are poorly drained soils that occupy narrow valley bottoms and depressions in moraines. The vegetation is principally sedges, mosses, and low shrubs. The soils are shallow over ice-rich permafrost. See *65a* in table 6.

Pergelic Cryaquepts, very gravelly, nearly level to rolling, are poorly drained soils that occupy long gentle foot slopes and narrow drainageways. Frost scars are common. The vegetation includes shrubs, sedges, mosses, and lichens. Permafrost is normally within 24 inches (60 cm). See *75* in table 6.

In WESTERN ALASKA, except for a glaciated area east of Kotzebue, this association occupies unglaciated hills and low mountains with long smooth ridges separated by narrow valleys. Elevations range from about 500 to 3,000 feet (150 to 900 m). Soils in these areas formed in material derived from the underlying bedrock. On the steep upper slopes the mantle of weathered material is commonly shallow and there are local outcrops of bedrock. Shallow ice-rich permafrost underlies most soils in the deeper residual and colluvial material of north-facing slopes, toe slopes, and valley bottoms, but permafrost is deep or absent on south-facing slopes. In places, the toe slopes and valley bottoms have a thin silty mantle.

High ridges and peaks above 1,000 feet (300 m) have a cover of low shrubs and forbs. Lower southerly side slopes in most places support white spruce, shrubs, and, in a few places, paper birch, alder, and grasses. Toe slopes, north-facing slopes, and valley bottoms have black spruce, sedges, mosses, and other water-tolerant plants. Areas bordering the Bering Sea have no trees, but otherwise have the same sequence of vegetation. Frost scars, stone stripes, solifluction lobes, and other frost features are common in those areas.

Soils of this association cannot be used for agriculture or commercial forestry. The vegetation provides habitat for caribou, moose, and other wildlife and is suitable for reindeer range. Steep slopes and permafrost are severe limitations for most kinds of construction.

Principal components in western Alaska:

Pergelic Cryumbrepts, very gravelly, hilly to steep, (30 percent) are well drained soils on slopes and ridges above tree line. They formed in shattered residual and colluvial material that is 20 to 30 inches (50 to 75 cm) thick over bedrock near the tops of ridges, but more than 4 feet (120 cm) thick close to the tree line. The vegetation is principally low shrubs and forbs. Typically, the soils have an upper layer of dark reddish brown silt loam or gravelly silt loam over dark grayish brown very gravelly silt loam or loam. Ice-rich permafrost, if present, is many feet deep. See *100* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (30 percent) are poorly drained soils on steep, north-facing slopes, toe slopes of all aspects, and nearly level to rolling valley bottoms. The soils formed mostly in colluvial material but also in residual material at high elevations. The vegetation is either black spruce forest or sedge tussocks, mosses, and low shrubs and forbs. Typically, under a thick peaty surface mat, the soils consist of mottled gray very gravelly loam or silt loam over shallow, ice-rich permafrost. See *69* in table 6.

Lithic Ruptic-Entic Cryumbrepts, very gravelly, hilly to steep, (10 percent) are well drained soils on high ridgetops, in association with outcrops of bedrock. They formed in stony residual material less than 20 inches (50 cm) thick over consolidated bedrock. The vegetation is a sparse cover of low shrubs and forbs. There are many barren patches. The soils under vegetation have a very dark gray to dark reddish brown surface horizon over dark brown or gray very stony loam. Soils in barren areas are dark gray or gray throughout. See *98* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, (10 percent) are poorly drained soils that occupy some foot slopes and valley bottoms. They formed mostly in colluvial material. The vegetation is shrubs, mosses, and sedges. The soils have a thin mat of peaty material over mottled dark gray very gravelly loam. The permafrost table is at a depth of 3 to 5 feet (90 to 150 cm). See *76* in table 6.

Typic Cryumbrepts, very gravelly, hilly to steep, (10 percent) are well drained soils on southerly slopes below the tree line. They formed principally in very gravelly colluvium, in places with a thin mantle of silty windlaid material. They support an open forest of white spruce, paper birch, and alder. The forest floor has a dense cover of grasses and ferns.

Typically, these soils have a black or very dark gray, thick upper horizon over a dark yellowish brown subsoil and a substratum of dark grayish brown very gravelly silt loam. There is no permafrost. See *94* in table 6.

Other components (10 percent):

Lithic Cryorthents, very gravelly, hilly to steep, are well drained, gray soils on parts of high ridges under a sparse cover of low shrubs and forbs. Bedrock outcrop is common. See *16* in table 6.

Pergelic Cryochrepts, very gravelly, hilly to steep, are well drained, brown soils on steep slopes of high ridges under a cover of low shrubs and forbs. Small areas of Lithic Cryochrepts are included. See *93* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, are well drained soils with thin albic and spodic horizons on steep slopes directly above the tree line. The vegetation is shrubs, grasses, and other forbs. See *137* in table 6.

Rough mountainous land includes mostly unvegetated peaks and sharp ridgetops. See *145* in table 6.

IU3—Pergelic Cryumbrepts, very gravelly, hilly to steep-Rough mountainous land association is in the following major land resource areas:

	Acres
169 South Central Alaska Mountains	2,614,000
172 Copper River Plateau	498,000
173 Alaska Range	167,000
175 Kuskokwim Highlands	4,467,000
177 Norton Sound Highlands	1,287,000
179 Bering Sea Islands	224,000
Total	9,257,000

This association occupies mountainous areas throughout western, central, and southern Alaska (fig. 37). The landscape is made up largely of hilly alpine plateaus, rocky peaks, sharp ridges, steep mountain valleys, and foot slopes. The dominant soils in most areas formed in very stony and gravelly colluvial material of variable thickness over bedrock, but some of the soils in valleys and on foot slopes in glaciated areas formed in deposits of till. The vegetation is low shrubs, mosses, lichens, and a wide variety of short grasses and associated forbs.

Soils of the association are not suitable for cultivation or forestry, and because of the rugged terrain they have severe limitations for construction and engineering uses. Primarily, the association provides wildlife habitat for birds and mammals that frequent alpine areas.

Principal components:

Pergelic Cryumbrepts, very gravelly, hilly to steep, (40 percent) are the dominant soils on high alpine slopes and ridges close to mountain peaks. The vegetation, commonly interrupted by frost scars, is alpine tundra consisting of low shrubs, short grasses, forbs, lichens, and mosses. Beneath a thin surface mat of partially decomposed organic material, the soils have a very dark brown or dark reddish brown horizon, commonly 8 to 12 inches (20 to 30 cm) thick, formed in very gravelly and stony loam. They may or may not have a brown subsoil horizon. In most places the gravelly and stony material is about 20 to 40 inches (50 to 100 cm) thick over bedrock, but in others the soils may overlie thick deposits of glacial till. The soils are strongly acid. Mean annual soil temperatures are below freezing, but most soils are so coarse that no ice-rich permafrost is present. See *100* in table 6.

Rough mountainous land (30 percent) consists of areas of bare rock and stony rubble on mountain peaks and sharp ridges. There is little vegetation other than lichens. See *145* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (15 percent) are poorly drained soils with a shallow permafrost table in swales and on slopes affected by seepage. The vegetation is dominantly sedges, mosses, and low shrubs. Beneath a thick peaty surface mat the soils have mottled, dark gray horizons formed in very stony and gravelly loam. Depth to permafrost is usually less than 20 inches (50 cm). See *69* in table 6.

Other components (15 percent):

Lithic Ruptic-Entic Cryumbrepts, very gravelly, hilly to steep, are well drained soils that are less than 20 inches (50 cm) thick over bedrock. They occur on very steep slopes and ridgetops. The vegetation is alpine tundra. The mean annual soil temperature is below freezing. See *98* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, are poorly drained soils with permafrost on steep slopes affected by seepage. The vegetation is dominantly sedges, mosses, and low shrubs, but the peaty accumulation on the surface is less than 8 inches (20 cm) thick. The soil surface is commonly frost scarred. See *76* in table 6.

Pergelic Cryochrepts, very gravelly, hilly to steep, are well drained soils with no dark surface horizon on high slopes and ridges. The vegetation is alpine tundra. The mean annual soil temperature is below freezing. Bedrock is commonly 20 to 40 inches (50 to 100 cm) below the surface. See *93* in table 6.

Figure 37.—**Pergelic Cryumbrepts are dominant in mountain valleys, under shrubby alpine vegetation. Talkeetna Mountains.**

Pergelic Cryorthods, very gravelly, hilly to steep, are well drained soils with thin albic and spodic horizons on the alpine mountainsides of central and south central Alaska; the vegetation is alpine tundra. The mean annual soil temperature is below freezing. See *137* in table 6.

LF—Lava flows are in the following major land resource areas:

	Acres
171 Alaska Peninsula and Southwestern Islands	18,000
177 Norton Sound Highlands	123,000
Total	141,000

Lava flows with little or no soil cover occupy relatively small areas on the Seward Peninsula (fig. 38) and Unimak Island. The lava is mostly unvegetated, but low shrubs occur in depressions where weathered material has accumulated. The lava is generally level, but its surface is irregular.

Lava flows are unsuitable for any agricultural purpose except limited reindeer grazing. The rock provides a stable foundation for roads. Problems of water supply and sewage disposal severely limit construction of all but the most rudimentary buildings. The flows provide limited habitat for tundra wildlife.

Principal components:

Lava flows (80 percent) are barren except for lichens. In many places they are strongly fractured, but in large sections the original surface remains. Several lava flows of varying age are represented. See *143* in table 6.

Pergelic Cryaquepts, very gravelly, nearly level, (20 percent) are very shallow soils formed in shattered lava rock and weathering products washed in from the surrounding bare lava beds. In a few high spots with better drainage, there is a thin horizon sequence resembling that of Pergelic Cryorthods. For the most part the soils are usually wet and support a sparse shrubby vegetation. See *75* in table 6.

MA1—Pergelic Cryaquolls-Histic Pergelic Cryaquepts, loamy, nearly level to rolling association is in the following major land resource area:

	Acres
182 Arctic Coastal Plain	3,444,000

This association occupies extensive areas of the Arctic Coastal Plain east of the Colville River. Broad, nearly level low plains dotted with shallow thaw lakes dominate the landscape in areas near the coast. Stream terraces, alluvial fans, many small flood plains, and a

Figure 38.—Largely unvegetated Lava flows. Near Imuruk Lake, Seward Peninsula.

few low hills are also included. The elevations range from sea level to about 400 feet (120 m) on plains along the coast and to slightly over 1,000 feet (300 m) on a few included hills.

The entire association is underlain by thick permafrost and nearly all areas are strongly patterned with frost features common to the arctic tundra. The dominant soils are poorly drained and consist of loamy, nonacid and calcareous sediment under a cover of sedge tussocks, mosses, and low shrubs. Areas of very gravelly and sandy soils occur on terraces and flood plains bordering numerous streams flowing northward from the Brooks Range. Also included are very poorly drained fibrous peat soils that occupy lake borders, shallow depressions in terraces, and small drainageways.

Soils of the association are too cold for cultivation and, except for a few well drained very gravelly soils on the terraces, they have severe limitations for construction. The areas are used heavily by caribou and other wildlife species that frequent the arctic tundra. They would also be suitable as reindeer range.

Principal components:

Pergelic Cryaquolls, loamy, nearly level to moderately sloping, (30 percent) are poorly drained soils on nearly level coastal plains, terraces, and long foot slopes. They formed in nonacid and calcareous silty material under a cover of low shrubs, forbs, mosses, sedges, and lichens. Typically, under a surface mat of roots and organic material, the soils have a black mucky silt loam upper layer over mottled dark gray loamy material that contains frost-churned streaks of buried organic matter. Ice-rich permafrost is usually less than 12 inches (30 cm) below the organic mat. See *101* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (25 percent) are poorly drained soils on low plains, terraces, and long foot slopes. They formed in both nonacid and calcareous silty sediment under a cover of sedges, mosses, low shrubs, and forbs. Polygons, frost scars, and pingos are common surface features. Typically, under a surface layer of organic material ranging from 8 to 16 inches (20 to 40 cm) in thickness, the soils consist of dark gray, mottled silt loam or silty clay loam that contains dark frost-churned streaks of organic matter. A thin darkened layer of mixed mineral and organic material is common at the permafrost table, which is usually less than

12 inches (30 cm) below the mineral surface. See *65b* in table 6.

Pergelic Ruptic-Histic Cryaquepts, loamy, nearly level to rolling, (20 percent) are poorly drained soils commonly on the crests of very low broad knolls that are only a few feet above the surrounding plains. They also occur on convex foot slopes and in small areas on terraces. About 40 to 50 percent of the surface area is patterned with closely spaced, roughly circular, sparsely vegetated frost scars. In areas between the frost scars the surface is covered with a thick mat of mosses, lichens, low shrubs, sedges, and forbs. Both the soils in the frost scars and the soils under the vegetative mat consist of mottled dark gray nonacid to calcareous loamy material that contains black streaks of churned organic material. Depth to ice-rich permafrost is usually less than 10 inches (25 cm) in the soil under the thick vegetative mat but ranges up to about 24 inches (60 cm) in the sparsely vegetated frost scars. See *78* in table 6.

Pergelic Cryorthents, very gravelly, nearly level to rolling, (10 percent) are well drained soils on parts of low terraces bordering major streams and on a few low knolls and ridges. Frost features, including polygons and roughly circular frost scars, are weakly developed and much less prominent than in areas of poorly drained soils. The vegetation is mainly grasses, forbs, dwarf shrubs, lichens, and dryas. On these soils the vegetative mat is normally only 1 or 2 inches (2 or 5 cm) thick and in places on windswept knolls the surface is nearly bare. The soils consist of dark grayish brown nonacid or calcareous very gravelly sand or sandy loam. Although they have mean annual temperatures below freezing, they do not retain enough moisture for ice-rich permafrost to form. See *19* in table 6.

Pergelic Cryofibrists, nearly level, (10 percent) are very poorly drained organic soils with a shallow permafrost table. They occur in shallow basins in terraces and in areas bordering thaw lakes on coastal plains. The vegetation is mainly sedges. In summer the soils are always wet, and low areas are commonly ponded. The peat consists of very dark brown coarse sedge fibers that are usually very strongly acid. Below a depth of about 12 inches (30 cm), the material is perennially frozen and interbedded with thick layers of clear ice. See *28* in table 6.

Other components (5 percent):

Pergelic Cryaquepts, very gravelly, nearly level, are poorly drained very gravelly and sandy soils on flood plains. Permafrost is shallow. The soils are subject to periodic flooding. The vegetation is dominated by sedges, mosses, and dwarf shrubs. See *75* in table 6.

Pergelic Cryopsamments, sandy, nearly level to rolling, are well drained sandy soils on low stabilized dunes bordering flood plains. They have a moderately deep permafrost table. The vegetation is grasses, low shrubs, lichens, and forbs. See *23* in table 6.

MA2—Pergelic Cryaquolls, very gravelly, nearly level to rolling association is in the following major land resource area:

	Acres
180 Brooks Range	1,033,000

This association occupies the low parts of a broad glaciated basin in the upper Noatak River Valley in the western Brooks Range. Nearly level terraces and broad sloping valleys dominate the landscape. A few moraine hills, small lakes, and tributary streams of the Noatak River are included. Permafrost underlies the entire area, and the vegetation is tundra dominated by sedges, mosses, lichens, and low shrubs. Dwarf birch is also common and patches of willowbrush are scattered along the streams. Elevation ranges from about 800 feet (240 m) on the low terraces to 1,500 feet (450 m) on moraine hills.

The dominant soils are poorly drained and consist of very gravelly glaciofluvial material derived from limestone rock in the surrounding mountains. A few well drained soils formed in very gravelly, nonacid and calcareous drift on hilly moraines. Also included are fibrous peat soils in shallow depressions on terraces.

The soils of the association are too cold for cultivation and have severe limitations for most types of construction. Primarily, they provide habitat for caribou and other species of arctic wildlife. They are suitable for reindeer range.

Principal components:

Pergelic Cryaquolls, very gravelly, nearly level to rolling, (65 percent) are poorly drained soils with a shallow permafrost table that occupy broad nearly level terraces and foot slopes. They developed in nonacid and calcareous very gravelly loamy material under a vegetative cover dominated by sedges, mosses, and low shrubs. Typically, under a mat of partially decomposed organic material, the soils have a black mucky silt loam horizon over mottled, dark gray and dark grayish brown very gravelly silt loam or sandy loam. Depth to permafrost is about 10 to 20 inches (25 to 50 cm) beneath the organic mat. See *102* in table 6.

Pergelic Cryoborolls, very gravelly, hilly to steep, (15 percent) are well drained soils on low moraine hills. They formed in very gravelly glacial drift that contains material derived from limestone rock. The dominant vegetation is grasses, mosses, dryas, lichens, dwarf birch, and other low shrubs. Typically, under a few inches of peaty organic material, the soils have a very dark brown, humus-rich, nonacid or calcareous gravelly sandy loam horizon over dark grayish brown very gravelly drift. Though the mean annual soil temperature is below freezing, the soils seldom retain enough moisture to form ice lenses. See *107* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (10 percent) are poorly drained soils with a shallow permafrost table that occur in scattered areas on low terraces and long foot slopes. They formed in nonacid loamy sediment under a cover of sedge tussocks, mosses, and low shrubs. Typically, beneath a thick peaty surface mat, the soils consist of mottled dark gray, frost-churned silt loam. Depth to ice-rich permafrost is usually less than 10 inches (25 cm) below the organic mat. See *65b* in table 6.

Pergelic Cryofibrists, nearly level, (5 percent) are very poorly drained fibrous organic soils in shallow basins in low terraces. Under a thick cover of sedges and mosses, the peat consists mainly of very dark brown coarse sedge and moss fibers. Depth to ice-rich

permafrost is usually less than 10 inches (25 cm). See *28* in table 6.

Other components (5 percent):

Pergelic Cryaquepts, very gravelly, nearly level, are poorly drained soils with a shallow permafrost table on flood plains. The vegetation is dominantly sedges, mosses, and low shrubs. See *75* in table 6.

Pergelic Cryorthents, very gravelly, nearly level to rolling, are well drained soils on a few narrow terraces along streams. The vegetation is mainly low shrubs, lichens, mosses, and forbs. See *19* in table 6.

MA3—Pergelic Cryaquolls, very gravelly, nearly level to rolling-Pergelic Cryoborolls, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
180 Brooks Range	1,403,000
181 Arctic Foothills	793,000
Total	2,196,000

This association occupies low hills and broad valleys in the northern and western foot slopes of the Brooks Range. Moraines and outwash plains dotted with small lakes dominate the landscape. A few mountain foot slopes and high peaks are also included. Elevations range from about 500 to 3,000 feet (150 to 900 m) in nearly all areas except in a nonglaciated valley sloping to the coast of the Chukchi Sea. The vegetation in all areas is arctic tundra, and the entire association is underlain by permafrost.

The dominant soils in the association have a dark, humus-rich mineral surface horizon. They formed in glacial drift or colluvium derived from limestone and calcareous shale formations. On nearly level outwash plains and sloping valleys, most of the soils are poorly drained and wet during the summer. Most of the well drained soils occur on gravelly moraine hills and steep ridges.

Soils of the association are too cold for cultivation and have severe limitations for construction. Primarily, they provide habitat for caribou and other species of wildlife that frequent the arctic tundra. They are suitable for reindeer range.

Principal components:

Pergelic Cryaquolls, very gravelly, nearly level to rolling, (35 percent) are poorly drained soils on outwash plains, on foot slopes, and in broad valleys under a cover of sedges, mosses, and low shrubs. Typically, under a peaty surface mat, the soils have a black mucky silt loam horizon over mottled dark gray very gravelly sandy loam or silt loam. They are nonacid to calcareous and have a permafrost table that is usually less than 12 inches (30 cm) below the peaty surface. See *102* in table 6.

Pergelic Cryoborolls, very gravelly, hilly to steep, (25 percent) are well drained soils on moraine hills, ridges, and steep colluvial slopes. The vegetation is mainly grasses, forbs, lichens, mosses, dryas, and low shrubs. Typically, beneath a thin peaty surface mat, the soils have a very dark brown, humus-rich gravelly silt loam horizon over dark gray very gravelly sandy loam. They are nonacid to calcareous. Though the mean annual soil temperature is below freezing, the soils seldom retain enough moisture for clear ice lenses to form in the permafrost. See *107* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (15 percent) are poorly drained soils on low foot slopes and in valley bottoms under a cover of sedge tussocks, mosses, and low shrubs. Typically, they have a peaty surface mat 8 to 16 inches (20 to 40 cm) thick over mottled dark gray, frost-churned silt loam that contains streaks of black organic matter. Depth to ice-rich permafrost is usually less than 10 inches (25 cm) below the organic mat. See *65b* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, (10 percent) are well drained soils on high sharp ridgetops and on a few steep slopes under a sparse cover of grasses, lichens, and low shrubs. Typically, the soils consist of dark grayish brown very gravelly and stony silt loam or sandy loam. Though the mean annual temperature is below freezing, there is seldom enough moisture retained in the very gravelly material for ice-rich permafrost to form. See *20* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, (10 percent) are poorly drained soils in steep valleys and drainageways. Sedges, mosses, and low shrubs are the dominant plants. Typically, the soils have a thin peaty surface mat over mottled dark gray very gravelly and stony silt loam or sandy loam. The permafrost table is usually less than 20 inches (50 cm) below the surface. See *76* in table 6.

Other components (5 percent):

Pergelic Cryochrepts, very gravelly, hilly to steep, are well drained soils with brown upper horizons. They are on hilly moraines in close association with Pergelic Cryoborolls. The vegetation is a sparse cover of grasses, lichens, and low shrubs. See *93* in table 6.

Rubble land consists of areas of loose stones and gravel and little or no vegetation. It occurs on a few sharp windswept peaks and ridges. See *146* in table 6.

MB1—Typic Cryoborolls, loamy, nearly level to rolling association is in the following major land resource area:

	Acres
176 Interior Alaska Highlands	370,000

This association occupies only one area in the State, a high terrace north of the Yukon Flats between the Chandalar River and the Christian River that ranges in elevation from 600 feet to about 1,200 feet (180 to 370 m). The terrace is nearly level to undulating and is traversed by several small streams. A thick loess deposit covers the area. The soils are dominantly well drained, but in depressions they are poorly drained.

The vegetation has been burned repeatedly. Areas of well drained soils affected by recent fires have a cover of young aspen, willows, grasses, and other shrubs and forbs. Areas that have escaped recent burns have a cover of stunted white spruce and willows. Poorly drained soils support a black spruce forest.

Permafrost is discontinuous. Under recent burns there is no permafrost to depths of 4 feet (120 cm) or more, but some other areas are perennially frozen within 2 feet (60 cm) of the surface.

It is likely that good yields of grass, oats, barley, potatoes, and other vegetables could be obtained if this area were irrigated, but frost damage would be likely

in some years. Because of severe fires, there is little harvestable timber. Most areas are suitable for construction, but the deep silty soils and the possible presence of permafrost require detailed soil investigation and construction practices adapted to these conditions.

Principal components:

Typic Cryoborolls, loamy, nearly level to rolling, (80 percent) are well drained upland soils formed in nonacid silty loess. Polygons 12 to 18 inches (30 to 45 cm) high and 6 to 8 feet (180 to 240 cm) in diameter are common. Permafrost is discontinuous. Soils of this kind with permafrost are properly classified as Pergelic Cryoborolls but have not been identified separately in this area. The extent of soils underlain by permafrost is not known.

The vegetation on recently burned areas is young aspen, willows, grasses, and fireweed. Areas of older burns have stunted white spruce and willows.

Typically, these soils have a thin layer of partly decomposed organic matter over dark brown and very dark grayish brown silt loam that extends to depths of 20 inches (50 cm) or more. The substratum is dark grayish brown. See *104* in table 6.

Pergelic Cryaquolls, loamy, nearly level to rolling, (10 percent) are poorly drained soils in broad depressions and drainageways. They formed in silty alluvial material and are underlain by ice-rich permafrost at shallow depths. The vegetation is black spruce, shrubs, mosses, and sedges.

Typically, these soils have a thick mat of moss peat over mottled dark grayish brown silt loam. Permafrost occurs at a depth of about 10 inches (25 cm) below the mineral surface. See *101* in table 6.

Typic Cryochrepts, loamy, nearly level to rolling, (10 percent) are well drained soils principally on south-facing slopes under a white spruce forest. The soils are brown or dark brown to a depth of 12 to 20 inches (30 to 50 cm) over a dark gray substratum. The texture is silt loam throughout. See *81b* in table 6.

MB2—Pergelic Cryoborolls-Pergelic Cryaquolls, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
179 Bering Sea Islands	174,000
180 Brooks Range	696,000
181 Arctic Foothills	4,898,000
Total	5,768,000

This association is extensive on the hilly northern and western slopes of the Brooks Range (fig. 39), and on St. Lawrence and St. Matthew Islands in the Bering Sea. High rounded ridges and hilly plateaus separated by deep valleys dominate the landscape. Isolated mountains, a few sharp peaks, steep foot slopes, and some broad gently sloping valleys are also included. Though most areas in the association range from about 1,000 to 3,000 feet (300 to 900 m) above sea level, a few included mountain slopes have elevations of more than 4,000 feet (1,200 m), and some areas on the islands and the far western parts of the Arctic Foothills slope to the sea coast. The vegetation is tundra, and the entire association is within the zone of continuous permafrost.

On hills and foot slopes in glaciated valleys near steep mountains of the Brooks Range, the dominant soils formed in very gravelly drift. In nonglaciated areas, the major soils formed in very gravelly colluvium and residual material weathered from calcareous rock.

None of the soils are potentially suitable for cultivation, and most have severe limitations for building and construction. Primarily, they support habitat for caribou and other species of wildlife that frequent the arctic tundra. They are suitable for reindeer range.

Principal components:

Pergelic Cryoborolls, very gravelly, hilly to steep, (35 percent) are well drained very gravelly loamy soils on hilly moraines and south-facing colluvial slopes. The vegetation is tundra dominated by grasses, mosses, lichens, dryas, forbs, and dwarf shrubs. Typically, under a thin peaty surface mat, the soils have a dark, humus-rich, nonacid or calcareous gravelly silt loam to sandy loam upper layer over dark gray very gravelly sand or sandy loam. Though the mean annual soil temperature is below freezing, thick lenses of ice-rich permafrost seldom form in the coarse material. See *107* in table 6.

Pergelic Cryaquolls, very gravelly, hilly to steep, (20 percent) are poorly drained soils with permafrost on foot slopes, north-facing slopes, and low hills. In summer they thaw to a depth of 10 to 24 inches (25 to 60 cm) and are usually wet. The vegetative cover is mainly sedges, mosses, low shrubs, and other tundra plants, but in places it is interrupted with barren frost scars. Typically, under a peaty surface mat, the soils have a black, nonacid mucky silt loam upper layer over mottled dark gray very gravelly loamy material derived from calcareous rocks. See *103* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, (15 percent) are poorly drained very gravelly and stony soils in steep drainageways and on steep north-facing slopes of high ridges. The vegetation, which is dominated by sedges, mosses, and low tundra shrubs, is commonly interrupted by unvegetated frost scars and stone stripes. Typically, beneath a thin peaty surface and in frost scars, the soils consist of mottled dark gray very gravelly and stony silt loam or sandy loam. Depth to permafrost ranges from about 10 to 30 inches (25 to 75 cm). See *76* in table 6.

Pergelic Cryaquolls, loamy, nearly level to rolling, (10 percent) are poorly drained soils formed in nonacid and calcareous loamy sediment in valley bottoms and on long colluvial foot slopes. The vegetation is mainly sedges, mosses, and low shrubs. Typically, the soils have a peaty surface mat ranging from about 6 to 12 inches (15 to 30 cm) in thickness. Beneath the mat the soils have a black mucky silt loam upper layer over mottled dark gray, frost-churned silt loam. In summer they thaw to a depth of 10 to 20 inches (25 to 50 cm) below the surface mat and are usually wet. The perennially frozen material generally contains thick lenses of clear ice. See *101* in table 6.

Lithic Cryorthents, very gravelly, hilly to steep, (10 percent) are well drained to excessively drained soils on high hills and ridgetops. The vegetative cover, which is commonly interrupted by patches of bare ground and stone stripes, is mainly grasses, lichens, mosses, and dwarf tundra shrubs. Typically, the soils

Figure 39.—**Pergelic Cryoborolls are on hills under low shrubby vegetation. Pergelic Cryoquolls occupy valleys and foot slopes under vegetation dominated by sedges and mosses. East of Canning River.**

under the thin vegetative mat and in the bare patches consist of dark grayish brown very gravelly and stony silt loam or sandy loam a few inches to 20 inches (50 cm) thick over bedrock. The mean annual soil temperature is below freezing. See *16* in table 6.

Other components (10 percent):

Rubble land consists of areas of loose stones and gravel on the tops of high windswept ridges. There is little or no vegetation other than patches of lichens. See *146* in table 6.

Rough mountainous land includes rockslides and areas of bare rock on mountainsides and isolated peaks. There is little or no vegetation. See *145* in table 6.

Pergelic Cryofibrists, nearly level, are very poorly drained organic soils in shallow depressions. The vegetation is dominantly sedges and mosses. The permafrost table is usually less than 12 inches (30 cm) deep. See *28* in table 6.

RM1—Rough mountainous land is in the following major land resource areas:

		Acres
168	Southeastern Alaska	8,361,000
169	South Central Alaska Mountains	21,174,000
170	Cook Inlet-Susitna Lowland	44,000
171	Alaska Peninsula and Southwestern Islands	6,730,000
173	Alaska Range	12,528,000
175	Kuskokwim Highlands	959,000
176	Interior Alaska Highlands	174,000
178	Western Alaska Coastal Plains and Deltas	18,000
179	Bering Sea Islands	7,000
180	Brooks Range	17,731,000
181	Arctic Foothills	47,000
	Total	67,773,000

Rough mountainous land is made up of steep rocky slopes, icefields, and glaciers (fig. 40). Some slopes in the mountains support a sparse shrubby vegetation, but most are barren. Thin soils occur in the vegetated areas on lower slopes and in valleys, but almost all are stony and shallow over bedrock or bouldery deposits. In most cases, these soils can be classified into the same subgroups as those of hilly areas adjacent to the mountains.

The major mountain ranges in Alaska are mapped predominantly as Rough mountainous land. Rough mountainous land also occurs on the highest parts of generally hilly areas, on isolated peaks surrounded by low rolling or level areas, and on steep, rocky islands. About 16,550,000 acres, mostly in Southeastern Alaska, the South Central Alaska Mountains, the Alaska Peninsula, and the Alaska Range, are covered by permanent ice. Most of the major rivers in Alaska carry a heavy load of sediment originating in outflows from these icefields and glaciers.

Rough mountainous land is unsuitable for agriculture or forestry. Roads are feasible only in major valleys through the mountains. Steep slopes and problems of water supply and sewage disposal severely limit the choice of building sites and commonly increase the cost of construction. Mountainous areas generally have great esthetic value and provide many recreational opportunities. They are the favored habitat of several species of birds and mammals.

RM2—Rough mountainous land-Lithic Cryorthents, very gravelly, hilly to steep association is in the following major land resource areas:

Figure 40.—**Icefield and glacier, Kenai Mountains.**

	Acres
176 Interior Alaska Highlands	924,000
177 Norton Sound Highlands	953,000
180 Brooks Range	4,745,000
181 Arctic Foothills	240,000
Total	6,862,000

This association occupies deeply dissected foothills of the Brooks Range and isolated mountain masses in the Arctic Foothills, Interior Highlands, and Norton Sound Highlands. Elevations range from sea level to about 5,000 feet (1,500 m). At higher elevations the mountains are very steep and rocky, but valleys and lower side slopes are generally less steep. Ice-rich permafrost underlies soils at the lower elevations. Soils at higher elevations are too shallow over bedrock for ground ice to form.

Higher elevations are barren or have a sparse cover of low alpine plants. Most lower slopes support a denser, dominantly shrubby vegetation. Black spruce forests occur in some valley bottoms.

Soils of this association are too steep or too cold for cultivation or forestry. Some of the lower areas are suitable for grazing by reindeer. Steep slopes and permafrost are severe limitations for most kinds of construction. The areas are useful primarily for wildlife and recreation.

Principal components:

Rough mountainous land (45 percent) consists of barren rocky peaks and ridges, stony and bouldery slopes with little or no vegetation, and very shallow and stony soils with sparse alpine vegetation. Many of the peaks formerly were ice covered and exhibit features characteristic of glaciated areas. Some peaks in the interior, however, were never glaciated. See *145* in table 6.

Lithic Cryorthents, very gravelly, hilly to steep, (25 percent) are well drained, gray soils that are shallow over bedrock. They occur on steep side slopes and low ridges. They support a sparse alpine vegetation. Mean annual temperatures are below freezing, but ice-rich permafrost seldom forms above the bedrock. See *16* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, (10 percent) are poorly drained soils that occupy valley bottoms, high benches, and lower parts of steep mountainsides. They support a dense vegetation of willows, dwarf birch, other shrubs, mosses, and sedges. Black spruce occupies some valley bottoms. Typically, the soils have a thin mat of organic material over mottled dark gray very gravelly silt loam. They are perennially frozen below depths of 12 to 24 inches (30 to 60 cm). During the summer, the soils are nearly always wet because of water perched above the permafrost. See *76* in table 6.

Other components (20 percent):

Lithic Cryochrepts, very gravelly, hilly to steep, are well drained soils on parts of high ridges in all areas. They are shallow over bedrock and support sparse alpine tundra vegetation. See *92a* and *92b* in table 6.

Lithic Cryorthods, very gravelly, hilly to steep, are well drained soils on high ridges in the interior highlands. They are shallow over bedrock and support alpine tundra vegetation. See *134* in table 6.

Pergelic Cryoborolls, very gravelly, hilly to steep, are well drained soils on steep slopes in arctic and western Alaska, especially in areas with calcareous bedrock. They support low tundra vegetation. See *107* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, are well drained soils on ridges and steep slopes in interior Alaska. They support low tundra vegetation. See *137* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, are well drained soils on ridges and steep slopes, especially in western Alaska. They support low tundra vegetation. See *100* in table 6.

Lithic Cryaquepts, very gravelly, hilly to steep, are poorly drained soils in upper parts of drainageways. They are shallow over bedrock. The vegetation is willows, other shrubs, sedges, and mosses. See *71* in table 6.

Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling, are poorly drained soils with shallow ice-rich permafrost in valley bottoms. They support black spruce, willows, other shrubs, sedges, and mosses. See *68* in table 6.

SH1—Typic Cryohumods, loamy, hilly to steep-Humic Cryorthods, very gravelly, hilly to steep association is in the following major land resource area:

	Acres
168 Southeastern Alaska	301,000

This association occupies steep hills in areas that are covered in large part by volcanic ash, apparently from Mt. Edgecumbe on Kruzof Island. The ash is many feet thick on lower slopes, where it overlies glacial till, but as a result of erosion it is thinner on higher slopes. Large areas on the upper slopes have been subject to repeated landslides and snowslides.

Most of the area below elevations of about 2,000 feet (600 m) is covered by a forest of Sitka spruce, western hemlock, and cedar. Near the tree line mountain hemlock is an important component of the forest. At higher elevations, above tree line, the vegetation is dominantly sedges and low alpine forbs and shrubs.

Soils under the forest include well drained to poorly drained mineral soils in positions ranging from steep hillsides to nearly level terraces and valley bottoms and organic soils on slopes subject to seepage. In areas above tree line, shallow organic soils over bedrock are dominant.

Except for small gardens, nearly all of the area is too steep for crops. The forested slopes produce large volumes of harvestable timber. Steep slopes, highly erodible mineral soils, and continually wet organic soils are severe limiting factors for most construction. The most suitable soils in the area for construction are those on narrow terraces bordering streams.

Principal components:

Typic Cryohumods, loamy, hilly to steep, (20 percent) are well drained soils on hills of relatively low elevation, normally on glacial moraines. The soils formed in a thick deposit of sandy and cindery volcanic ash over glacial till. Beneath a mat of forest litter, they consist of a thin gray albic horizon and a thick spodic horizon that is black at the top and grades downward to yellowish red and dark brown.

Thin seams of leached organic matter are common in the lower part of the horizon. The soils are normally very strongly acid at the surface but become considerably less acid with depth. See *116* in table 6.

Humic Cryorthods, very gravelly, hilly to steep, (15 percent) occur on higher parts of long steep slopes, above and below the regional tree line. They are well drained and formed in material mixed as a result of landslides and snowslides. The vegetation usually consists of a dense stand of alder and other shrubs and forbs. Textures for the most part are very gravelly silt loam and very gravelly sandy loam. An albic horizon is present in places, but the soils generally consist only of dark brown or dark reddish brown spodic horizons that are highly variable in depth. See *131a* in table 6.

Cryic Placohumods, loamy, hilly to steep, (10 percent) occur in close association with the Typic Cryohumods on low hills. They differ from those soils principally by the presence of a very thin undulating placic horizon in the upper part of the spodic horizon but in other respects are similar. The vegetation is a forest dominated by western hemlock and Sitka spruce. See *119* in table 6.

Lithic Cryohemists, hilly to steep, (10 percent) occur above the tree line. The vegetation is dominantly sedges, with minor amounts of sphagnum moss, deer cabbage, and other forbs and shrubs. The soils consist of partially decomposed sedge peat 10 to 40 inches (25 to 100 cm) thick over bedrock and are nearly always saturated. In winter the snow cover is very thick, and the soils probably do not freeze. See *38* in table 6.

Humic Cryorthods, very gravelly, nearly level to rolling, (5 percent) occur on narrow high terraces bordering streams. They support a forest of Sitka spruce and western hemlock. They consist of stratified sand, sandy loam, and silt loam less than 30 inches (75 cm) thick over a thick deposit of waterlaid very gravelly sand. The soils have a thin albic horizon over a brown or reddish brown spodic horizon which extends to or into the underlying gravel. See *130* in table 6.

Placic Haplaquods, loamy, nearly level to rolling, (5 percent) are poorly drained soils of lower slopes subject to seepage. They formed in silty and sandy volcanic ash and layers of cinders. The vegetation is a forest of Sitka spruce, mountain hemlock, and Alaska cedar. The soils have a thick mat of forest litter and a thin gray albic horizon over a black to dark reddish brown spodic horizon. An undulating thin placic horizon, which effectively restricts internal drainage, occurs at depths of 24 inches (60 cm) or less. Seep water usually flows above this horizon. See *115* in table 6.

Lithic Cryaquods, very gravelly, hilly to steep, (5 percent) are somewhat poorly drained soils on high forested slopes subject to seepage from areas of organic soils above tree line. The soils formed in sandy volcanic ash 10 to 20 inches (25 to 50 cm) thick over bedrock. They support a slow-growing stand dominated by mountain hemlock and some western hemlock, Alaska cedar, and Sitka spruce. The soils have thin albic and spodic horizons with mottles and streaks resulting from their frequent periods of saturation. Rock outcrops are common. These soils are closely associated with Lithic Cryohemists and other organic soils of alpine areas. See *109* in table 6.

Typic Sphagnofibrists, nearly level to rolling, (5 percent) generally occupy level to moderately sloping benches and depressions at lower elevations, but a few areas are above tree line. Most areas of these soils support only mosses, sedges, and low forbs and shrubs. Small ponds are common. In places there are stands of lodgepole pine. They consist of very strongly acid sphagnum moss peat and layers of fibrous sedge peat. Thickness of the peat ranges from 5 to as much as 50 feet (1.5 to 15 m). In many areas the surface of the peat bog is domed, with the center of the bog considerably higher than the edges. The substratum is glacial till. See *30* in table 6.

Typic Cryohemists, nearly level to steep, (5 percent) are very poorly drained organic soils on lower hillsides. In places they support a sparse stand of lodgepole pine and cedar, but sedges and mosses are the dominant plants. The soils consist of partially decomposed peat derived principally from sedges. Layers of moss peat also occur, especially in the upper part of the soil. The peat is underlain at depths of more than 4 feet (120 cm) by compact glacial till. Gradients are dominantly gently sloping to moderately steep, but the soils are nearly always completely saturated. See *37* in table 6.

Lithic Cryosaprists, hilly to steep, (5 percent) occur in areas above or just below tree line. They consist mostly of highly decomposed peat less than 30 inches (75 cm) thick over bedrock. The vegetation in areas above tree line is dominantly low shrubs and forbs and occasional clumps of nearly prostrate mountain hemlock. Below tree line the soils support a slow-growing forest dominated by mountain hemlock and Alaska cedar. The soils are almost always saturated and, because of the thick snow cover, probably do not freeze in winter. See *42* in table 6.

Terric Cryosaprists, nearly level to rolling, (5 percent) are poorly drained soils in association with Placic Haplaquods on lower slopes subject to almost continual seepage. They support a forest dominated by mountain hemlock and Alaska cedar. The soils consist of 16 to 40 inches (40 to 100 cm) of strongly acid, well decomposed organic matter over volcanic ash or glacial till. The underlying material is usually compact and slowly permeable. See *43* in table 6.

Rough mountainous land, (5 percent) is high peaks with steep rocky slopes and almost no soil cover. Most areas are bare, but some are covered with mosses, lichens, and patches of mountain hemlock and shrubs growing directly on the rock or in stony rubble. See *145* in table 6.

Other components (5 percent):

Fluvaquentic Cryofibrists, nearly level, are very poorly drained soils that occupy level marshes in valley bottoms and are nearly always completely saturated. They consist of very strongly acid fibrous sedge peat containing one or more thin layers of mineral peat. The vegetation is dominantly sedges, but there are stunted trees in places. See *27* in table 6.

Typic Cryofluvents, loamy, nearly level, are well drained soils on low terraces adjoining areas of Humic Cryorthods on higher terraces. The vegetation is a forest of Sitka spruce and western hemlock. The soils

consist of stratified sand, sandy loam, and silt loam over a substratum of very gravelly sand. See *7a* in table 6.

Lithic Cryohumods, loamy, hilly to steep, are well drained soils in small areas above tree line, surrounded by organic soils. They formed in thin deposits of volcanic ash over bedrock. See *117* in table 6.

SO1—Typic Cryorthods, loamy, nearly level to rolling-Sphagnic Borofibrists, nearly level association is in the following major land resource area:

	Acres
170 Cook Inlet-Susitna Lowland	2,926,000

This association occupies areas in the Susitna Valley (fig. 41) and on the Kenai Peninsula that are dominated by low rolling glacial moraines and many depressions filled by lakes or muskegs. Also included are broad level terraces bordering major rivers, a few areas of low dunes close to the terraces, and remnants of an unglaciated plain in the southwestern part of the Kenai Peninsula. Many small streams, each with its own flood plain, flow through the areas. In several places flood plains, terraces, and outwash plains were formed during the period of rapid glacial retreat by glacial streams that no longer exist. Elevations are mostly below 500 feet (150 m).

The low hills consist of gravelly glacial deposits, ranging from gravelly clay loam to very gravelly sand. Terraces and outwash plains are made up principally of waterworked very gravelly sand. The hills, the terraces, and the outwash plains are mantled with silty windlaid material of varying thickness. This material consists of loess blown from the flood plains of streams and rivers carrying glacial outflow water and volcanic ash originating in mountains to the west. The ash oc-

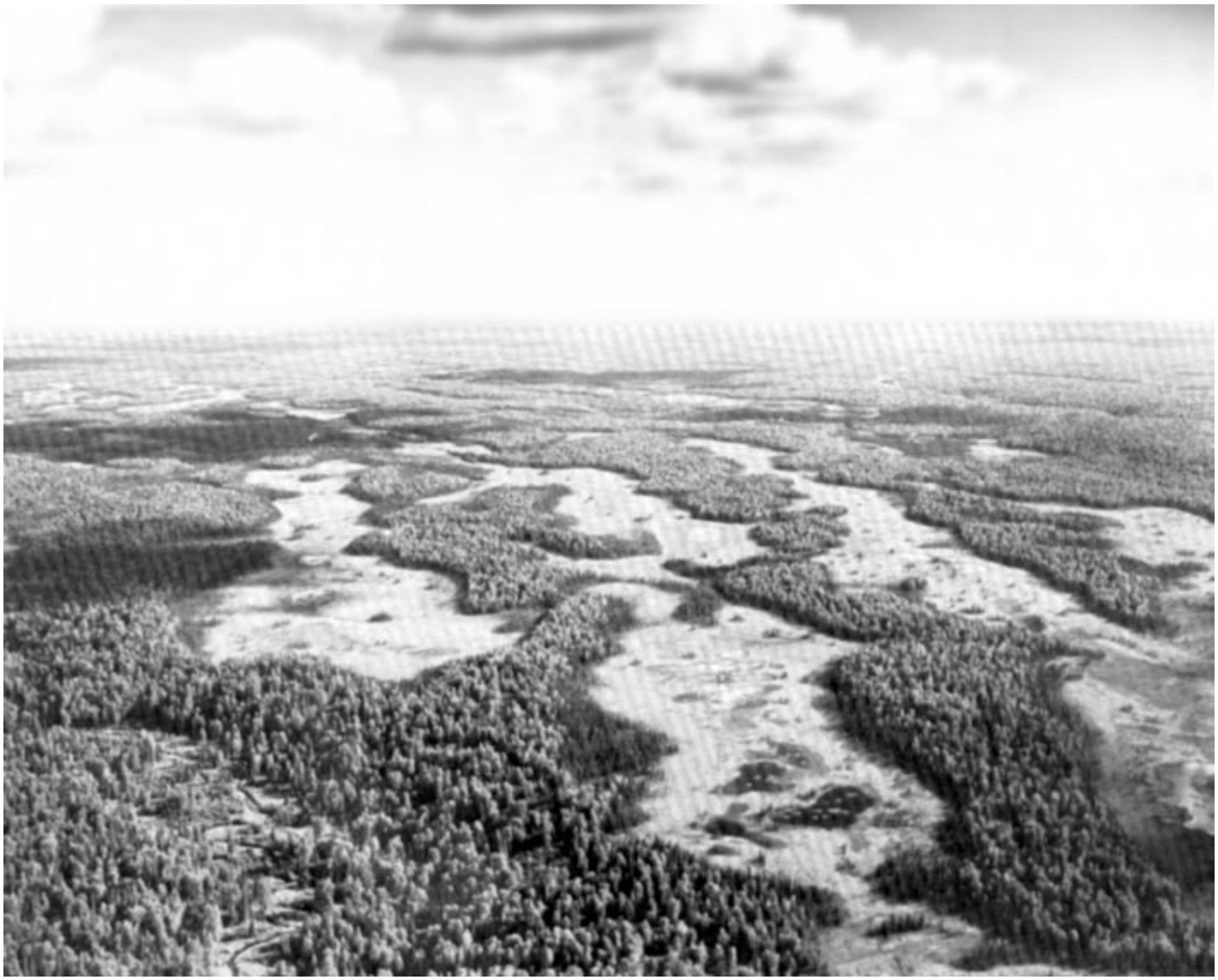

***Figure 41.*—Typic Cryorthods, under a white spruce-paper birch forest, occupy low moraine hills. Sphagnic Borofibrists occupy nearly level depressions between hills. Southwest of Talkeetna.**

curs as thin bands in the loess and as thick deposits over older loess accumulations. Soils on the flood plains of smaller streams range from very gravelly clay loam to stratified sand and silt loam. In a few areas they are very high in organic matter. There is no permafrost.

Most of the hills, terraces, and outwash plains support a forest dominated by white spruce and paper birch. Quaking aspen is prominent in a few places, and cottonwood occurs in areas close to large streams and Cook Inlet. Vegetation on the muskegs is mostly mosses, sedges, and associated low shrubs and forbs, but clumps and a few extensive stands of black spruce are common. Black spruce is the principal tree on soils with impeded drainage on flood plains, in shallow upland depressions, and in areas bordering muskegs. Grass stands occur in a few places on flood plains and in shallow depressions in the Kenai Peninsula.

There is some farming, logging, and urban development in a few areas, but most of the association is unsettled and is used primarily by wildlife. In general, the well drained soils on nearly level to rolling uplands are potentially suitable for cultivation or forestry. They have few limitations for roads, structures, and other intensive uses. Many of the other soils, however, have one or more restrictive features, such as a high water table, periodic flooding, steep slopes, poor stability, slow permeability, and stoniness, that severely limit their potential for use.

Principal components:

Typic Cryorthods, loamy, nearly level to rolling, (30 percent) are well drained soils that occur extensively on low hills, terraces, and outwash plains. They formed in silty loess or ash 20 to more than 40 inches (50 to 100 cm) thick over gravelly to very gravelly glacial till, waterworked material, or, in a few places, dune sand. They support forests dominated by white spruce and paper birch.

The soils, under a surface mat of forest litter, consist of a thin, gray albic horizon and a dark reddish brown to brown spodic horizon that grades within a depth of 20 inches (50 cm) to gray or olive unaltered parent material. At some depth greater than 20 inches (50 cm) the texture changes abruptly from silt loam to the coarse underlying material.

In the Susitna Valley, soils of this subgroup commonly have two sequences of albic and spodic horizons, one above the other, formed in separate deposits of loess or ash. There was sufficient time between deposits to have permitted formation of the lower sequence. See *120* in table 6.

Sphagnic Borofibrists, nearly level, (25 percent) are very poorly drained, fibrous organic soils in depressions in and between glacial moraines and on low parts of terraces and flood plains. They consist of a surface layer of undecomposed sphagnum moss over laminated moss and sedge peat. Mosses are dominant in the upper part of the stratified peat, but sedges make up a higher proportion in the lower part. The peat is 5 feet (1.5 m) to more than 10 feet (3 m) thick over a mineral substratum. In places a layer of finely divided, highly decomposed organic material is directly above the substratum. In other places the peat is underlain by a deposit of marl. A few soils have a layer of water within the peat or between the peat and the underlying mineral material.

Vegetation on these soils is chiefly mosses and associated low shrubs, forbs, and sedges. Large areas also support a slow-growing forest of black spruce. See *25* in table 6.

Typic Cryorthods, very gravelly, nearly level to rolling, (10 percent) have a thin silty mantle over a very gravelly substratum. The lower part of the spodic horizon may extend into the underlying material. In other respects the soils are similar to the loamy Typic Cryorthods. See *124a* in table 6.

Typic Cryorthods, loamy, hilly to steep, (5 percent) occur on moraine hills that are generally steeper than most hills in this area. Soils and vegetation are essentially the same as those of the Typic Cryorthods, loamy, nearly level to rolling. See *121* in table 6.

Typic Cryorthods, very gravelly, hilly to steep, (5 percent) occur on moraine hills. They have only a thin silty mantle. They are generally closely associated with similar nearly level to rolling soils. Soils and vegetation are essentially the same as those of the Typic Cryorthods, very gravelly, nearly level to rolling. See *125b* in table 6.

Terric Borohemists, nearly level, (5 percent) are shallow organic soils in depressions in hills, nearly level terraces, and outwash plains. They are made up dominantly of partially decomposed sedge fibers, though the surface layer may be sphagnum moss peat. In some places the shallow peat is dominantly fibrous. The soils in such places would be properly classified as Terric Borofibrists. See *36* in table 6.

Other components (20 percent):

Entic Cryorthods, sandy, nearly level to rolling, have thin albic and spodic horizons. They are on low stabilized dunes adjacent to major flood plains and tidal flats. The upper few inches is commonly silty. The soils support a forest of white spruce, paper birch, quaking aspen, and, in places, cottonwood. See *126* in table 6.

Sideric Cryaquods, loamy, nearly level to rolling, are moderately well drained to somewhat poorly drained soils with recognizable spodic horizons. Most formed in silty material over a slowly permeable substratum. The vegetation is a forest of black spruce, white spruce, paper birch, and alder. See *111* in table 6.

Sideric Cryaquods, very gravelly, nearly level to rolling, are moderately well drained to somewhat poorly drained soils on terraces and outwash plains. They formed in shallow silty material over a substratum of very gravelly sand. The vegetation is generally black spruce forest. See *113* in table 6.

Typic Cryaquods, sandy, nearly level, are poorly drained sandy soils with a thick albic horizon over a layered, strongly cemented spodic horizon. They occupy positions at the edge of large muskegs where there is frequent fluctuation of the water table. The vegetation is principally mosses and low shrubs. See *108* in table 6.

Typic Cryaquents, loamy, nearly level, are poorly drained, generally mottled, gray or greenish gray sandy and silty soils on flood plains, slopes subject to seepage, and coastal meadows. The vegetation is black

and white spruce, cottonwood, birch, and willows on the flood plains and in seep areas and sedges, water-tolerant shrubs, and forbs on the coastal meadows. See *2a* in table 6.

Typic Cryaquepts, very gravelly, nearly level, are poorly drained, mottled olive or gray silty soils with a shallow substratum of very gravelly sand. They occupy broad level depressions on terraces and outwash plains, usually adjacent to muskegs. The vegetation is dominantly black spruce. See *56* in table 6.

Histic Cryaquepts, loamy, nearly level to rolling, are poorly drained soils with a thick surface mat of organic material, a dark upper mineral horizon, and mottled gray to greenish gray lower horizons. Texture ranges from silt loam to clay loam over a substratum of firm glacial till. The soils occur in areas bordering lakes and muskegs, flood plains of smaller streams, and slopes subject to seepage. The vegetation is either black spruce forest or tall brush and grasses. See *62* in table 6.

Humic Cryaquepts, loamy, nearly level, are poorly drained soils with a thin surface mat of organic matter; a thick, dark upper mineral horizon, mottled olive, gray, or grayish brown lower horizons; and a firm, slowly permeable substratum. They occur in depressions in moraines and on flood plains of smaller streams. The vegetation is either black spruce forest or tall brush and grasses. See *70* in table 6.

Dystric Cryandepts, loamy, nearly level to rolling, are dark brown to brown soils formed in silty volcanic ash over a substratum of stratified sedimentary material. They occur in grassy openings in forested areas and on low hills bordering Cook Inlet, mostly on the southern part of the Kenai Peninsula. The vegetation is dominantly grasses and associated forbs and shrubs. See *50a* in table 6.

Terric Borofibrists, nearly level, consist of fibrous sedge peat over a substratum of silty and clayey tidal deposits. They occur in close association with Typic Cryaquents in coastal meadows. The vegetation is dominantly sedges. See *26* in table 6.

Terric Borosaprists, nearly level, consist of well-decomposed peat with lenses of volcanic ash over a silty or sandy substratum. They occur in depressions in uplands, commonly in association with Dystric Cryandepts. The native vegetation is dominantly grass. See *41* in table 6.

Aeric Humic Cryaquepts, loamy, nearly level to rolling, have a dark upper horizon, a mottled olive brown subsoil, and a stratified sandy and silty substratum. They occur on broad terraces. The native vegetation is an open forest and grass. See *60* in table 6.

SO2—Typic Cryorthods, loamy, hilly to steep-Sphagnic Borofibrists, nearly level association is in the following major land resource area:

	Acres
170 Cook Inlet-Susitna Lowland	453,000

This association occupies an area on the Kenai Peninsula of hilly moraines interspersed with many lakes and poorly drained muskegs (fig. 42). Small stream terraces and a few outwash plains are also included. Elevations are less than 1,000 feet (300 m) above sea level.

On most of the uplands, soils formed in a mantle of silty loess over very gravelly glacial drift. They support forests dominated by paper birch and white spruce. Poorly drained muskegs, in depressions in moraines and low areas on terraces, consist mainly of coarse fibrous peat that is usually more than 60 inches (150 cm) thick. The vegetation on muskegs is dominantly a cover of mosses, sedges, and low shrubs, but many areas also support stands of black spruce. There is no permafrost in the area.

Nearly all of the association is within the boundaries of the Kenai National Moose Range, a wildlife refuge. Except for a few areas used for oil development the native vegetation on the soils is undisturbed. Steep slopes or wetness severely limits the use of most soils for intensive purposes. Nearly level to rolling upland soils, however, have few limitations.

Principal components:

Typic Cryorthods, loamy, hilly to steep, (35 percent) are well drained soils on moraine hills under forests dominated by paper birch and white spruce. Beneath a surface mat of partially decomposed forest litter, the soils have a thin, gray silt loam albic horizon over a dark reddish brown to yellowish brown silt loam spodic horizon about 12 to 18 inches (30 to 45 cm) thick. Below the spodic horizon is olive gray silt loam to a depth of 24 to 40 inches (60 to 100 cm). The silty material includes both loess and fine volcanic ash. The substratum is glacial drift that ranges from gravelly loam to very gravelly sand. See *121* in table 4.

Sphagnic Borofibrists, nearly level, (30 percent) consist of deep, very poorly drained peat in muskegs. They occur in depressions between moraine hills and on low areas on terraces. The vegetation is mainly mosses, sedges, low shrubs, and, in places, forests of black spruce. Beneath a mat of live moss and roots, the upper 20 to 30 inches (50 to 75 cm) of peat consists mainly of dark yellowish brown, slightly decomposed sphagnum moss fibers. In the lower layers the organic material is partially decomposed and consists of interbedded sphagnum moss and sedge peat. The water table in these areas is usually near the surface. See *25* in table 6.

Typic Cryorthods, very gravelly, hilly to steep, (10 percent) are well drained soils on moraines in places where the mantle of silty loess is very thin over gravelly glacial drift. The vegetation is forest dominated by white spruce and paper birch. In a typical profile, the soils have a thin, gray silt loam albic horizon over a dark reddish brown to yellowish brown spodic horizon about 12 to 18 inches (30 to 45 cm) thick. In some soils the spodic horizon developed entirely in silty loess, but in others the lower layers extend into very gravelly sand or sandy loam. See *125b* in table 6.

Typic Cryorthods, loamy, nearly level to rolling, (10 percent) are well drained silty soils on terraces and low rolling moraines under forests of paper birch and white spruce. Typically, they have a thin, gray silt loam albic horizon and a silt loam spodic horizon about 12 to 18 inches (30 to 45 cm) thick that is dark reddish brown in the upper few inches and grades to dark brown and dark yellowish brown in the lower parts. Beneath the spodic horizon is olive or olive gray silt loam to depths of 24 to 40 inches (60 to 100 cm). The

Figure 42.—Typic Cryorthods occupy forested moraine hills and Sphagnic Borofibrists occur in muskegs. Much of the forest has been burned. The subsequent shrubby growth makes excellent browse for moose. Northern Kenai Peninsula.

substratum is very gravelly sand or sandy loam or stratified sedimentary material. See *120* in table 6.

Typic Cryorthods, very gravelly, nearly level to rolling, (5 percent) are shallow, well drained soils on terraces and low moraines in places where the mantle of silty loess is less than 24 inches (60 cm) thick over very gravelly glacial drift. The vegetation is usually a forest dominated by white spruce and paper birch. Beneath a thin surface mat of partially decomposed forest litter, the soils have a thin gray silt loam albic horizon over a spodic horizon about 12 to 18 inches (30 to 45 cm) thick. The upper few inches of the spodic horizon is dark reddish brown silt loam and the lower layers are brown to yellowish brown. In the shallower soils the bottom of the spodic horizon commonly extends a few inches into the underlying very gravelly sand or sandy loam. See *124a* in table 6.

Other components (10 percent):

Typic Cryaquepts, loamy, nearly level to rolling, are poorly drained silt loams in gentle swales, drainageways, and low areas bordering muskegs. The vegetation is commonly a forest of black spruce. See *55a* in table 6.

Histic Cryaquepts, loamy, nearly level to rolling, are poorly drained soils in shallow depressions and drainageways under forests of black spruce and a thick ground cover of mosses. Many of the soils are stony. See *62* in table 6.

Humic Cryaquepts, loamy, nearly level to rolling, are poorly drained soils with black mucky silt loam upper layers. They occur in drainageways under a cover of alder, grasses, sedges, and paper birch. See *70* in table 6.

Sideric Cryaquods, loamy, nearly level to rolling, are

moderately well drained silt loams in gentle swales in terraces. They support forests of either white spruce and paper birch or black spruce. See *111* in table 6.

Sideric Cryaquods, sandy, nearly level to rolling, are moderately well drained soils formed in sandy material on stream terraces under forests dominated by either paper birch and white spruce or black spruce. See *112* in table 6.

Terric Borohemists, nearly level, are very poorly drained, shallow organic soils made up of partially decomposed peat derived from sedges and mosses. They occur mostly in shallow depressions in terraces. See *36* in table 6.

SO3—Typic Cryorthods, sandy, nearly level to rolling-Histic Pergelic Cryaquepts, loamy, nearly level to rolling association is in the following major land resource areas:

	Acres
174 Interior Alaska Lowlands	344,000
175 Kuskokwim Highlands	124,000
Total	468,000

This association occupies low stabilized dunes near the Kuskokwim River and its tributaries in the vicinities of McGrath, Stony River, and Sleetmute. Elevations range from about 200 to 500 feet (60 to 150 m) above sea level. Though the areas are of relatively low relief, most of the landscape is made up of small undulating and rolling dunes separated by a complex pattern of gentle swales and troughs. A few nearly level terraces and steep choppy slopes on the larger dunes are included.

Nearly all of the soils in the association formed in a mantle of silty loess laid down over thick deposits of eolian fine sand. The loess mantle ranges in thickness from a few inches on the crests of dunes to more than 30 inches (75 cm) in swales and depressions. The soils on dunes are generally well drained or excessively drained and have no permafrost. They support forests dominated by quaking aspen, white spruce, and paper birch. In swales and troughs between the dunes, most of the soils are poorly drained and have a shallow permafrost table. They support a cover of either black spruce or tundra that is mainly sedges, mosses, and shrubs.

Largely because of low moisture supplying capacity, the dominant soils are only marginal for crops and commercial forestry. In general, most of the well drained and excessively drained soils on low dunes have few or moderate limitations for buildings and other types of construction. The poorly drained soils have severe limitations for all intensive uses.

Principal components:

Typic Cryorthods, sandy, nearly level to rolling, (40 percent) are the dominant soils on low undulating to rolling dunes and a few nearly level terraces. They are well drained to excessively drained and acid. They commonly support a forest dominated by quaking aspen, white spruce, and paper birch. In a typical profile, the soils have a very thin, gray surface layer over 6 to 12 inches (15 to 30 cm) of dark reddish brown to brown silt loam and 6 to 24 inches (15 to 60 cm) of dark gray silt loam. The substratum is fine sand. See *122* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (30 percent) are poorly drained soils with permafrost in swales between dunes and in shallow depressions in a few terraces. The vegetation is either a forest of black spruce and a ground cover of moss or a tundra that is mainly sedges, mosses, and shrubs. Typically, the soils have a peaty surface layer 8 to 16 inches (20 to 40 cm) thick over mottled dark gray or greenish gray silt loam that is perennially frozen below a depth of 10 to 20 inches (25 to 50 cm). The silty material is generally more than 20 inches (50 cm) thick over fine sand. See *65a* in table 6.

Typic Cryorthents, loamy, nearly level to rolling, (10 percent) are well drained soils without permafrost on low dunes close to major streams under a forest of white spruce, quaking aspen, and paper birch. Beneath a thin mat of forest litter, the soils consist of dark grayish brown silt loam with many streaks and patches of dark yellowish brown. The silty material is 30 to 50 inches (75 to 125 cm) thick over fine sand. See *10a* in table 6.

Typic Cryopsamments, sandy, hilly to steep, (10 percent) are deep, sandy, excessively drained soils on hilly dunes close to major streams. The vegetation is a forest dominated by quaking aspen. Beneath the forest litter is grayish brown silt loam or fine sandy loam that is less than 10 inches (25 cm) thick over grayish brown fine sand. See *22* in table 6.

Typic Cryorthods, sandy, hilly to steep, (10 percent) are excessively drained sandy soils without permafrost on large hilly dunes with short choppy slopes. The vegetation is a forest dominated by white spruce and quaking aspen. Typically, beneath a surface mat of forest litter, the soils have a very thin, gray silt loam horizon over 6 to 12 inches (15 to 30 cm) of dark reddish brown to brown silt loam or fine sandy loam. The loamy material is about 10 to 20 inches (25 to 50 cm) thick over fine sand. See *123b* in table 6.

SO4—Typic Cryorthods, very gravelly, nearly level to rolling-Sphagnic Borofibrists, nearly level association is in the following major land resource area:

	Acres
170 Cook Inlet-Susitna Lowland	261,000

This association occupies broad glaciated lowlands near the head of Cook Inlet. Elevations range from about 100 to 500 feet (30 to 150 m) above sea level. The entire area is free of permafrost. Low rolling moraine hills and nearly level to undulating outwash plains interspersed with many small poorly drained muskegs and lakes are major features of the landscape.

The dominant soils in the association are well drained and formed in a thin mantle of silty loess over thick deposits of very gravelly glacial drift. Many depressions and shallow basins, however, are filled with very poorly drained deposits of sphagnum moss peat. In addition, soils formed in silty and sandy waterlaid sediment are common on low terraces and flood plains bordering the streams.

Although many areas of the shallow, well drained soils on moraines and outwash plains have been cleared for homesites and other uses, most are still covered by forests dominated by paper birch and white spruce. The vegetation in areas of very poorly drained peat is mainly mosses, sedges, shrubs, and clumps of stunted

black spruce. Soils bordering streams generally support stands of cottonwood, white spruce, and paper birch or dense patches of alder and willow brush.

In general, most of the well drained soils in the association have few or moderate limitations for buildings or other types of construction and are capable of producing commercial stands of timber. Many of these soils are also suitable for forage crops, small grains, and vegetables, but a high proportion of them are very shallow over gravel and are considered marginal for cultivation. The very poorly drained peat has severe limitations for construction and is not suitable for agriculture or commercial forestry. Construction of buildings and other structures should also be avoided on soils of alluvial plains that are susceptible to flooding.

Principal components:

Typic Cryorthods, very gravelly, nearly level to rolling, (40 percent) are dominant on nearly level to undulating outwash plains and rolling moraines. They are well drained to excessively drained. They formed in a mantle of silty loess about 5 to 18 inches (12 to 45 cm) thick over very gravelly glacial drift. Though many areas are cleared for homesites, farming, and other development, a high proportion is forested with paper birch and white spruce. Typically, the soils have a thin gray silt upper layer over reddish brown to yellowish brown layers about 6 to 12 inches (15 to 30 cm) thick. The lower part of these layers and the substratum consist of very gravelly sand or sandy loam that contains many stones and boulders. See *124a* in table 6.

Sphagnic Borofibrists, nearly level, (30 percent) are very poorly drained organic soils in broad irregular depressions in outwash plains and moraines. The vegetation is mainly sphagnum moss, low shrubs, and clumps of stunted black spruce. Beneath the surface mat of moss, the peat is largely layers of slightly decomposed moss and sedge fibers. It is extremely acid and usually saturated throughout the summer. The peat is frozen to depths of several feet in the winter. See *25* in table 6.

Typic Cryorthods, very gravelly, hilly to steep, (10 percent) are shallow and very shallow, excessively drained soils on scattered hilly moraines and short steep escarpments. The vegetation is dominantly a forest of paper birch and white spruce. In a typical profile, the soils have a thin gray surface layer over a dark reddish brown to yellowish subsurface layer 6 to 12 inches (12 to 63 cm) thick. The substratum is very gravelly coarse sand or sandy loam. See *125b* in table 6.

Histic Cryaquepts, very gravelly, nearly level to rolling, (5 percent) are very poorly drained soils in broad, nearly level depressions on muskeg borders and in low areas bordering secondary streams. They are generally covered with a thick mat of sphagnum moss and support scattered stands of black spruce, willows, and low shrubs. In a typical profile, the soils have a dark brown peaty surface layer 8 to 16 inches (20 to 40 cm) thick over mottled dark gray very stony silt loam. They are usually wet throughout the summer and the water table is commonly less than 2 feet (60 cm) below the surface. See *63* in table 6.

Typic Cryaquepts, loamy, nearly level to rolling, (5 percent) are poorly drained, moderately deep to deep soils in gentle swales, shallow depressions, and low areas bordering muskegs. They support forests of black spruce and, in places, stands of paper birch and white spruce. Beneath a thin peaty surface mat the soils consist of mottled dark gray to dark grayish brown silt loam that ranges from about 24 to 40 inches (60 to 100 cm) in thickness over very gravelly sandy loam. The water table is usually between 2 and 4 feet (60 and 120 cm) below the surface. See *55a* in table 6.

Other components (10 percent):

Humic Cryaquepts, loamy, nearly level to rolling, are moderately deep to deep, poorly drained soils with thick dark upper horizons. They are in drainageways and depressions. The vegetation is alder, willow, black spruce, and a few paper birch. See *70* in table 6.

Typic Cryaquents, very gravelly, nearly level to rolling, are poorly drained, stratified soils along secondary streams. The vegetation is mainly alder, willow, and black spruce. See *4* in table 6.

Typic Cryofluvents, loamy, nearly level to rolling, are moderately deep to deep, well drained soils on low terraces near streams under forests of cottonwood, white spruce, and paper birch. They are subject to occasional flooding. See *7a* in table 6.

SO5—Typic Cryorthods, very gravelly, hilly to steep-Sphagnic Borofibrists, nearly level association is in the following major land resource areas:

	Acres
169 South Central Alaska Mountains	29,000
170 Cook Inlet-Susitna Lowland	457,000
Total	486,000

This association occupies moraines and associated muskegs and outwash plains in areas bordering the Chugach and Kenai mountains near the head of Cook Inlet. Elevations range from sea level along the coast of Knik and Turnagain Arms to about 1,000 feet (300 m) near the mountains. On the hills and plains, soils formed in a thin mantle of silty loess over very gravelly and stony glacial drift are dominant. In the muskegs, most of the soils consist of fibrous peat derived from mosses and sedges. Small areas of soils formed in clayey marine deposits and a few soils consisting of loamy waterlaid sediment are also included. There is no permafrost.

Although parts of the association are densely populated, much of it is still covered by the native vegetation. Forests of paper birch and white spruce are dominant on most of the well drained soils, and stands of black spruce are common on poorly drained mineral soils. Areas of peat have either a cover of mosses, sedges, and shrubs or a forest of black spruce. Stands of cottonwood, alder, and willow are common on many of the soils bordering streams.

Largely because of steep slopes or poor drainage, a high proportion of the soils have severe limitations for structures or other types of intensive use and are not suitable for cultivation. Though less extensive, most of the well drained soils with slopes of less than 12 percent have slight or moderate limitations for construction and are generally the best sites for buildings and other structures. Many of these soils are also suitable for gardening, but most are shallow over gravel and are marginal for extensive cultivation.

Principal components:

Typic Cryorthods, very gravelly, hilly to steep, (45 percent) are shallow, well drained, very strongly acid soils on hilly moraines. They formed in a thin mantle of silty loess over very gravelly glacial till. The native vegetation is a forest dominated by paper birch and white spruce. Typically, beneath a thin surface mat of partially decomposed forest litter, the soils have a thin, gray albic horizon and a reddish brown to yellowish brown spodic horizon about 6 to 12 inches (15 to 30 cm) thick formed in 5 to 20 inches of silty loess over very gravelly sand or sandy loam. In many places the gravelly material contains cobblestones and boulders. See *125b* and *125c* in table 6.

Sphagnic Borofibrists, nearly level, (25 percent) consist of very poorly drained, extremely acid peat. They occur in nearly level depressions in moraines and outwash plains. The vegetation is mainly mosses, sedges, shrubs, and scattered forests of black spruce. Beneath the vegetative mat, the peat is dark brown, slightly decomposed, sphagnum moss fibers interbedded with layers of coarse sedge fibers. The organic material is more than 60 inches (150 cm) thick. The water table is usually near the surface. See *25* in table 6.

Typic Cryorthods, very gravelly, nearly level to rolling, (15 percent) are shallow, well drained soils on scattered outwash plains and low rolling moraines. The native vegetation is forest dominated by paper birch and white spruce. In a typical profile, the soils have a thin surface mat of partially decomposed forest litter, a thin, gray albic horizon, and a reddish brown to yellowish brown spodic horizon about 6 to 12 inches (15 to 30 cm) thick. The soils formed in a mantle of silty loess 5 to 24 inches (12 to 60 cm) thick over very gravelly sand or sandy loam that commonly contains cobblestones and boulders. See *124a* and *124b* in table 6.

Other components (15 percent):

Typic Cryaquepts, loamy, nearly level, are poorly and somewhat poorly drained soils in depressions and other nearly level low areas. The vegetation is commonly black spruce or a cover of alder and willow brush. See *55a* in table 6.

Humic Cryaquepts, loamy, nearly level, are poorly drained soils in drainageways and depressions. They have a thick black mucky surface layer and are covered with alders, willows, and paper birch or a stand of black spruce. See *70* in table 6.

Histic Cryaquepts, very gravelly, nearly level, are very poorly drained soils in low areas bordering muskegs and in drainageways. They have a thick peaty surface layer. The water table is usually near the surface. The vegetation is either a forest of black spruce or a cover of mosses, sedges, and shrubs. See *63* in table 6.

Sideric Cryaquods, very gravelly, nearly level to rolling, are somewhat poorly drained and moderately well drained soils on gentle slopes and low areas that receive seepage. The vegetation is generally a forest of black spruce. The substratum ranges from very gravelly sandy loam to very gravelly silty clay loam and is usually firm. See *113* in table 6.

Terric Borohemists, nearly level, consists of shallow, very poorly drained, partially decomposed peat in slight depressions and low areas. The vegetation is either a forest of black spruce or a cover of sedges and mosses. See *36* in table 6.

Typic Cryorthods, loamy, nearly level to rolling, are moderately deep to deep, well drained soils on low moraines and outwash plains. The native vegetation is forest dominated by paper birch and white spruce. See *120* in table 6.

SO6—Typic Cryorthods-Lithic Cryumbrepts, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
169 South Central Alaska Mountains	605,000
175 Kuskokwim Highlands	286,000
Total	891,000

This association occupies two separate areas, one in south central Alaska and the other in southwestern Alaska. Though the dominant soils in each area have similar characteristics, the areas differ in landscape features and in some of the associated soils.

In the SOUTH CENTRAL ALASKA MOUNTAINS the association occupies alpine benches, foot slopes, and deeply entrenched valleys in western parts of the Talkeetna Mountains. Elevations in most of the area are between 1,000 and 4,000 feet (300 and 1,200 m) above sea level but range to more than 5,000 feet (1,500 m) on a few mountain peaks and ridges.

Nearly all areas below 4,000 feet (1,200 m) have been glaciated, and most of the soils formed in very gravelly and stony drift and colluvium. Shallow soils and outcrops of bedrock are common on steep slopes and high benches near the included mountain peaks, which consist mainly of bare rock and rockslides. The dominant vegetation is subalpine shrubs on middle slopes and low alpine plants at higher elevations. The soils in valleys and on lower foot slopes commonly support partially open forests of white spruce and paper birch and a dense understory of alder brush.

Largely because of rugged relief and stoniness, soils of the association are not potentially suitable for cultivation and have severe limitations for construction. Primarily, they provide wildlife habitat, especially for mammals and birds that frequent the fringes of alpine areas.

Principal components in the South Central Alaska Mountains:

Typic Cryorthods, very gravelly, hilly to steep, (30 percent) are well drained soils in valleys, on forested lower foot slopes, and on some slopes above tree line. At lower elevations they commonly support open forests of white spruce and paper birch and a dense understory of tall shrubs. Above tree line the vegetation is mainly a cover of alpine shrubs, mosses, lichens, and forbs. Typically, beneath a thin mat of partially decomposed organic matter, the soils have a thin, gray albic horizon and a dark reddish brown to yellowish brown spodic horizon about 8 to 12 inches (20 to 30 cm) thick developed in very gravelly sandy loam to silt loam drift or colluvium that contains many stones and boulders. In places, bedrock is only 20 to 40 inches (50 to 100 cm) below the surface. See *125c* in table 6.

Lithic Cryumbrepts, very gravelly, hilly to steep, (20

percent) are well drained soils shallow over bedrock. They occur on steep slopes and ridges above tree line under a cover of alpine shrubs, grasses, mosses, lichens, and forbs. In a typical profile, the soils have a dark brown very gravelly silt loam surface layer about 4 to 8 inches (10 to 20 cm) thick over grayish brown very stony and gravelly silt loam or sandy loam. Bedrock is less than 20 inches (50 cm) below the surface. See *97* in table 6.

Typic Cryaquepts, very gravelly, hilly to steep, (15 percent) are poorly drained soils in steep drainageways and on slopes affected by seepage. The principal vegetation is sedges, mosses, alder, and willow. Beneath a thin peaty surface mat, the soils consist of mottled dark gray very stony and gravelly silt loam. See *57* in table 6.

Rough mountainous land (15 percent) consists mainly of bare rock and rockslides on high peaks and ridges. It also includes patches of very shallow soils covered with low alpine plants. See *145* in table 6.

Entic Cryumbrepts, very gravelly, hilly to steep, (10 percent) are well drained soils on alpine slopes under a cover of low shrubs, grasses, mosses, lichens, and forbs. Beneath a thin mat of partially decomposed organic matter, the soils have a dark brown very gravelly silt loam upper layer about 4 to 8 inches (10 to 20 cm) thick over grayish brown very stony and gravelly silt loam or sandy loam. In places, bedrock is only 20 to 40 inches (50 to 100 cm) below the surface. See *96* in table 6.

Humic Cryorthods, very gravelly, hilly to steep, (10 percent) are well drained soils commonly on slopes just above tree line under a cover of alder brush and tall grass. Typically, they have a thin, gray albic horizon over a spodic horizon about 12 to 16 inches (30 to 40 cm) thick that is very dark reddish brown in the upper part and dark brown to yellowish brown in the lower part. The soils generally developed in a thin mantle of silt loam over very gravelly silt loam or sandy loam glacial drift or colluvium that contains many stones and boulders. See *131a* in table 6.

In the KUSKOKWIM HIGHLANDS the association occupies foot slopes, hills, and broad valleys near mountains in southwestern Alaska. Elevations range from about 1,000 to 2,500 feet (300 to 750 m) above sea level. Most of the soils in valleys and on low hills formed in very gravelly and stony deposits of glacial drift or colluvial material. The well drained soils in these areas have no permafrost and support forests dominated by white spruce and paper birch. Poorly drained soils with permafrost occupy the lower foot slopes and valley bottoms. The plant cover is mosses, sedges, low shrubs, and patches of black spruce. The principal soils on hills and slopes above tree line formed in very gravelly and stony material commonly 10 to 40 inches (25 to 100 cm) thick over bedrock. These soils support alpine tundra shrubs, mosses, lichens, and grasses.

In general, soils of the association in the Highlands are not potentially suitable for cultivation, and largely because of steep slopes they have severe limitations for construction. Primarily, they provide habitat suitable for caribou, moose, bear, birds, and many small mammals.

Principal components in the Kuskokwim Highlands:

Typic Cryorthods, very gravelly, hilly to steep, (30 percent) are well drained soils without permafrost on low hills and in sloping valleys under open forests of white spruce, paper birch, and tall brush. Beneath a mat of forest litter, the soils have a thin, gray silt loam albic horizon and a reddish brown to yellowish brown gravelly silt loam spodic horizon 8 to 12 inches (20 to 30 cm) thick. The underlying material consists of olive brown to olive gray very gravelly and stony sandy loam. See *125d* in table 6.

Lithic Cryumbrepts, very gravelly, hilly to steep, (25 percent) are shallow, well drained soils on high hills and ridges above tree line. They formed in very gravelly and stony material less than 20 inches (50 cm) thick over bedrock. Beneath a cover of shrubs, grasses, mosses, and forbs, the soils have a dark brown gravelly silt loam upper layer about 6 to 10 inches (15 to 25 cm) thick over grayish brown or olive gray very gravelly and stony sandy loam. See *97* in table 6.

Entic Cryumbrepts, very gravelly, hilly to steep, (15 percent) are well drained soils on slopes directly above tree line under a cover of tall shrubs, grasses, and forbs. Typically, they have a dark brown gravelly silt loam upper layer 8 to 12 inches (20 to 30 cm) thick over grayish brown to olive gray very gravelly and stony sandy loam. Bedrock is commonly 20 to 40 inches (50 to 100 cm) below the surface, but in places it is deeper. See *96* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (15 percent) are poorly drained soils with a shallow permafrost table on low foot slopes and gently sloping valley bottoms. The vegetation is a forest of black spruce or a cover of sedges, mosses, and low shrubs. Beneath a thick peaty surface mat, the soils consist of mottled gray silt loam or gravelly silt loam that is perennially frozen at depths of 12 to 24 inches (30 to 60 cm) below the mineral surface. During the summer the soils are usually wet. See *65a* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, (15 percent) are poorly drained soils with permafrost in steep drainageways and in swales on high ridges under a cover of sedges, mosses, and low shrubs. Typically, they have a thin peaty surface layer over mottled dark gray very gravelly and stony silt loam or sandy loam. The permafrost table is generally 20 to 30 inches (50 to 75 cm) below the surface. See *76* in table 6.

SO7—Humic Cryorthods, loamy, nearly level to rolling-Pergelic Cryofibrists, nearly level association is in the following major land resource areas:

	Acres
175 Kuskokwim Highlands	1,197,000
178 Western Alaska Coastal Plains and Deltas	62,000
Total	1,259,000

This association occupies outwash plains and low moraines in the Nushagak River Valley north of Dillingham and in areas west of Lake Clark. A few choppy moraine hills and many muskegs, lakes, and streams are included in the landscape. Elevations in most areas are less than 1,000 feet (300 m) above sea level.

The dominant soils of the association are well drained. They formed in a moderately thick mantle of silty volcanic ash over very gravelly glacial drift on terraces and moraines. They support forests dominated

by either white spruce and paper birch or black spruce. Poorly drained organic soils in muskegs and most poorly drained mineral soils in depressions in terraces have a shallow permafrost table and a vegetative cover that is mainly sedges, mosses, and low shrubs. Some of the poorly drained mineral soils also support stands of stunted black spruce.

Most of the well drained soils in the association are potentially suitable for cultivation, but the choice of crops that can be grown on them may be severely limited by cool temperatures during the growing season. Most of the forests are relatively slow-growing and have little, if any, potential for commercial forestry. The level to rolling well drained soils have few limitations for construction or other engineering uses. Steep well drained soils and the poorly drained soils have severe limitations for all intensive use.

Principal components:

Humic Cryorthods, loamy, nearly level to rolling, (45 percent) are well drained soils without permafrost on nearly level to rolling terraces and moraines under forests dominated by either white spruce and paper birch or black spruce. They formed in silty volcanic ash about 24 to 40 inches (60 to 100 cm) thick over very gravelly glacial drift. Below the organic surface mat, the soils have a thin, gray silt loam albic horizon and a silty spodic horizon about 16 to 20 inches (40 to 50 cm) thick that is very dark reddish brown in the upper part and yellowish brown in the lower part. The soils are very strongly acid. See *128* in table 6.

Pergelic Cryofibrists, nearly level, (25 percent) are very poorly drained fibrous organic soils with permafrost in slight depressions. The vegetation is mainly sedges and mosses. Beneath a thick vegetative mat, the peat consists of dark brown slightly decomposed fibers derived mainly from sedges and mosses. Depth to permafrost is generally less than 24 inches (60 cm). See *28* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (15 percent) are poorly drained silty soils with permafrost in slight depressions and swales in terraces and moraines. The vegetation is mainly sedge tussocks, mosses, low shrubs, and scattered patches of black spruce. Beneath a thick peaty surface mat is mottled gray silt loam. Depth to permafrost is generally less than 24 inches (60 cm). See *65a* and *65b* in table 6.

Humic Cryorthods, very gravelly, hilly to steep, (15 percent) are well drained soils on the tops of moraine hills under a cover of alder, grasses, low shrubs, and a few white spruce. They formed in silty volcanic ash less than 24 inches (60 cm) thick over very gravelly sandy loam drift. Typically, the soils have a thin, gray silt loam albic horizon and a spodic horizon about 16 to 20 inches (40 to 50 cm) thick. The upper part of the spodic horizon is very dark reddish brown silt loam and the lower part, which commonly extends into the underlying very gravelly sandy loam, is dark brown or dark yellowish brown. The soils are very strongly acid. See *131d* in table 6.

SO8—Humic Cryorthods, loamy, hilly to steep association is in the following major land resource areas:

	Acres
170 Cook Inlet-Susitna Lowland	127,000
173 Alaska Range	257,000
Total	384,000

This association occupies foot slopes and foothills of the Alaska Range bordering the Susitna Valley. Moraine hills, glaciated valleys, and low benchlike ridges are included in the landscape. Elevations over most of the area are between 500 and 2,500 feet (150 to 750 m) above sea level.

The dominant soils developed in a thick mantle of silty volcanic ash over very gravelly and stony drift or colluvium. Most of the soils in depressions and sloping valley bottoms consist of fibrous organic material. The vegetation on most of the mineral soils is mainly tall grasses, alder, and patches of white spruce and paper birch. On the organic soils the vegetation is dominantly sedges, mosses, and low shrubs.

Largely because of steep slopes, the dominant soils are not potentially suitable for cultivation and have severe limitations for most engineering uses. They are suitable for summer grazing. Primarily, they provide habitat for moose, bear, and many species of small mammals and birds.

Principal components:

Humic Cryorthods, loamy, hilly to steep, (70 percent) are well drained soils on steep mountain foot slopes, low ridges, and moraine hills. They formed in 24 to 40 inches (60 to 100 cm) of silty volcanic ash and loess over stony, very gravelly glacial drift and colluvium. The vegetation is dominantly a cover of tall grasses, alder, forbs, and scattered stands of white spruce and paper birch. Typically, beneath a partially decomposed surface mat of organic material, the soils have a thin, dark gray silt loam albic horizon over a silt loam spodic horizon 16 to 20 inches (40 to 50 cm) thick. The spodic horizon is black in the upper few inches and grades to reddish brown and yellowish brown in the lower layers. The soils are very strongly acid. See *129* in table 6.

Typic Cryorthods, loamy, hilly to steep, (15 percent) are well drained soils on low hills under forests dominated by white spruce and paper birch. Typically, they have a thin gray albic horizon and a dark reddish brown to yellowish brown spodic horizon, about 12 to 18 inches (30 to 45 cm) thick, developed in 24 to 40 inches (60 to 100 cm) of silty volcanic ash and loess over very gravelly glacial till. The soils are very strongly acid. See *121* in table 6.

Sphagnic Borofibrists, nearly level to rolling, (15 percent) are very poorly drained organic soils in depressions and on slopes affected by seepage. The vegetation is dominantly a cover of mosses, sedges, and low shrubs. Beneath the plant cover is dark brown fibrous peat derived mainly from sphagnum moss. The peat is extremely acid and is more than 60 inches (150 cm) thick over glacial till. See *25* in table 6.

SO9—Humic Cryorthods, loamy, hilly to steep-Sphagnic Borofibrists, nearly level to rolling association is in the following major land resource area:

	Acres
170 Cook Inlet-Susitna Lowland	374,000

This association occupies benchlands close to the Alaska Range in western parts of the Susitna Valley. The landscape is dominated by moraine hills and foot slopes interspersed with many muskegs, lakes, and streams. Elevations range from about 1,000 to 2,000 feet (300 to 600 m) above sea level.

Most of the soils on foot slopes and moraines formed in a thick mantle of silty loess and volcanic ash under a vegetative cover dominated by grasses and alders. A few of these soils at lower elevations support forests of white spruce and paper birch. In very poorly drained muskegs, the soils consist mainly of fibrous peat and support a cover of sedges, mosses, and low shrubs.

Largely because of wetness or steep slopes most of the soils are not suitable for cultivation and have severe limitations for most types of engineering uses. The well drained soils under grass are suitable for summer grazing. The soils provide habitat for a variety of birds and mammals, including moose and bear.

Principal components:

Humic Cryorthods, loamy, hilly to steep, (40 percent) are well drained soils formed in 24 to 60 inches (60 to 150 cm) of silty volcanic ash and loess over very gravelly glacial till. They occupy foot slopes and moraine hills. The vegetation is mainly alders, tall grasses, and forbs.

Typically, the soils have a thin, dark gray silt loam albic horizon over a silt loam spodic horizon 16 to 20 inches (40 to 50 cm) thick. The upper part of the spodic horizon is usually black or very dusky red, and the lower part is brown or yellowish brown. The substratum is very gravelly glacial till. See *129* in table 6.

Sphagnic Borofibrists, nearly level to rolling, (40 percent) consist of very poorly drained fibrous organic soils that occupy nearly level to gently sloping muskegs. The vegetation is dominantly sedges, mosses, and low shrubs. Beneath a spongy surface mat of live moss and roots the soils consist mainly of dark brown, slightly decomposed sphagnum moss peat, interbedded with thin layers of fibrous sedge peat. The peat is extremely acid. Its thickness over glacial till ranges from 60 inches (150 cm) to many feet. The water table is always close to the surface. See *25* in table 6.

Typic Cryorthods, loamy, hilly to steep, (10 percent) are well drained soils on the lower slopes of a few moraine hills, under forests dominated by white spruce and paper birch. Typically, beneath a surface mat of organic material, the soils have a thin, gray silt loam albic horizon and a dark reddish brown to yellowish brown silt loam spodic horizon about 16 to 20 inches (40 to 50 cm) thick. The silty material consists of volcanic ash and loess that is about 25 to 50 inches (60 to 125 cm) thick over very gravelly glacial till. The soils are very strongly acid. See *121* in table 6.

Typic Cryaquepts; loamy, nearly level to rolling, (5 percent) are poorly drained soils in drainageways and swales. The vegetation is dominantly alder, grasses, and forbs. Typically, the soils have mottled dark gray horizons developed in thick deposits of silt loam sediment over very gravelly glacial till. See *55a* in table 6.

Other components (5 percent):

Histic Cryaquepts, loamy, nearly level to rolling, are poorly drained stony soils in drainageways. The vegetation is dominantly a thick cover of mosses and low shrubs. See *62* in table 6.

Humic Cryaquepts, loamy, nearly level to rolling, are poorly drained mucky silt loams on slopes affected by seepage. The vegetation is mainly alders, grasses, and forbs. See *70* in table 6.

SO10—Humic Cryorthods, very gravelly, hilly to steep association is in the following major land resource areas:

		Acres
169	South Central Alaska Mountains	1,047,000
170	Cook Inlet-Susitna Lowland	392,000
172	Copper River Plateau	221,000
175	Kuskokwim Highlands	1,062,000
	Total	2,722,000

This association occurs in widely separated areas in south central and southwestern Alaska. Although the dominant soils in each of the two major areas of occurrence have similar characteristics, the areas are described separately because of differences in some of the less extensive soils and in their pattern on the landscape.

On the SOUTH CENTRAL ALASKA MOUNTAINS, the COOK INLET-SUSITNA LOWLANDS, and the COPPER RIVER PLATEAU the association occupies foothills of the Alaska Range and Talkeetna Mountains bordering the Susitna Valley and deep mountain valleys in the Chugach Range north of the Gulf of Alaska. Mountain foot slopes, high alpine benches, foothills, and steep-sided valleys dominate the landscape. Although most areas are between 1,000 and 2,500 feet (300 and 750 m) above sea level, the extreme elevations range from about 200 feet (60 m) in a few valley bottoms to 3,500 feet (1,150 m) on high ridgetops.

The dominant soils formed in very gravelly drift or colluvium capped with a thin mantle of silty loess or a mixture of loess and volcanic ash. On steep mountainsides and high ridges, many soils are shallow over bedrock. All of the soils, except for a few in high alpine areas, are free of permafrost.

There are several principal types of vegetation. Forests dominated by white spruce and paper birch are common on valley bottoms and lower foot slopes. On intermediate slopes between tree line and high ridgetops, most of the soils support subalpine vegetation that is mainly willows, alders, tall grasses, forbs, shrubs, and widely scattered stunted black spruce. At higher elevations, generally above 2,500 feet (450 m), most of the soils are covered with low alpine shrubs, mosses, lichens, and short grasses.

In general, soils of the association in these areas are not potentially suitable for cultivation and, largely because of steep slopes, they have severe limitations for most types of construction. Many of the soils on intermediate slopes are suitable for summer livestock grazing, and a few of the soils at lower elevations support forests of commercial value. The wildlife habitat is utilized by relatively high populations of moose, bear, small mammals, and birds.

Principal components in the South Central Alaska Mountains, the Cook Inlet-Susitna Lowland, and the Copper River Plateau:

Humic Cryorthods, very gravelly, hilly to steep, (70 percent) are well drained soils on intermediate slopes between tree line and high alpine areas. The vegetation is mainly alder, willow, tall grasses, forbs, shrubs, and a few stunted white spruce. Typically, beneath a mat of partially decomposed organic matter the soils have a thin, gray albic horizon and a spodic horizon 16 to 20 inches (40 to 50 cm) thick that formed in a mixture of silt loam loess and volcanic ash about 10 to 24 inches (25 to 60 cm) thick over very gravelly and stony sandy loam till. The upper part of the spodic horizon is black to very dark reddish brown silt loam and grades to reddish brown and dark yellowish brown in the lower part. The soils are very strongly acid. See *131a* and *131b* in table 6.

Typic Cryorthods, very gravelly, hilly to steep, (10 percent) are well drained soils on slopes and in valleys below tree line. Under forests dominated by white spruce and paper birch, the soils formed in shallow silty loess and volcanic ash over very gravelly sandy loam drift. Typically, they have a thin, gray albic horizon and a spodic horizon about 12 to 18 inches (30 to 45 cm) thick. The spodic horizon is dark reddish brown in the upper part and grades to dark brown and dark yellowish brown in the lower parts. The soils are very strongly acid. See *125b* and *125c* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, (10 percent) are well drained soils on high alpine slopes or ridges that have a mean annual temperature below freezing. The vegetation is dominated by low shrubs, mosses, lichens, and other small alpine plants. Beneath a mat of partially decomposed organic material, the soils have a thin, gray albic horizon and a spodic horizon about 8 to 12 inches (20 to 30 cm) thick developed in very gravelly silt loam or loam. The spodic horizon is reddish brown in the upper part and brown to yellowish brown in the lower part. The soils are very strongly acid. In places they are underlain by bedrock at depths of 20 to 40 inches (50 to 100 cm). See *137* in table 6.

Other components (10 percent):

Typic Cryaquepts, very gravelly, nearly level to rolling, are poorly drained soils in drainageways and slight depressions in valley bottoms. The vegetation is dominantly alder, willow, sedges, grasses, and forbs. See *56* in table 6.

Typic Borohemists, nearly level, are very poorly drained organic soils in depressions in hills. The vegetation is mainly sedges and mosses. The peat is made up mostly of partially decomposed material derived from sedges and mosses. See *34* in table 6.

Sphagnic Borofibrists, nearly level, are very poorly drained fibrous organic soils in depressions under a thick cover of sphagnum moss and low shrubs. See *25* in table 6.

Rough mountainous land consists of areas of bare rock and rubble on a few peaks of high ridges. See *145* in table 6.

In the KUSKOKWIM HIGHLANDS the association occupies hills and intervening valleys near the Tikchik and Wood River Lakes. Elevations range from near sea level to about 2,500 feet (750 m) on most hills, but a few higher peaks are included. Most of the area has been glaciated.

The principal soils formed in shallow, silty volcanic ash over very gravelly loam till. The vegetation on well drained soils is dominantly grasses and alder and patches of stunted white spruce. A few poorly drained soils in valleys are covered with sedges, mosses, low shrubs, and scattered patches of black spruce.

Soils of the association in the Highlands are generally not suitable for cultivation or commercial forestry, and largely because of steep slopes many have severe limitations for engineering uses. The well drained soils are suitable for grazing. Nearly all of the soils are in native vegetation and provide habitat for a variety of species, including moose, caribou, bear, many small mammals, and birds.

Principal components in the Kuskokwim Highlands:

Humic Cryorthods, very gravelly, hilly to steep, (60 percent) are well drained soils on hills under a vegetative cover dominated by grasses and alder. A few stands of white spruce are on the lower slopes. Beneath a surface mat of partially decomposed organic material, the soils have a thin, gray albic horizon and a spodic horizon 12 to 18 inches (30 to 45 cm) thick that is black or very dark reddish brown in the upper part and grades to dark brown in the lower part. The soils are very strongly acid. They formed in shallow, silty volcanic ash over very gravelly glacial till.

Many of these soils have spodic horizons that are very low in iron. Such soils are properly classified as Typic Cryohumods. Because indentification is difficult in the absence of chemical analyses, they are mapped as Humic Cryorthods in this publication. See *131d* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (15 percent) are poorly drained soils with permafrost on low foot slopes and valley bottoms. The vegetation is dominantly sedges, mosses, low shrubs, and patches of black spruce. Typically, the soils have a thick peaty surface mat over mottled dark gray, frost-churned silt loam that is perennially frozen below depths of 10 to 20 inches (25 to 50 cm). See *65a* in table 6.

Lithic Cryorthods, loamy, hilly to steep, (10 percent) are well drained soils formed in shallow silty ash over bedrock. They occur on steep mountain foot slopes under a vegetative cover dominated by grasses and alder. Typically, the soils have a thin, gray silt loam albic horizon and a dark reddish brown to yellowish brown silt loam spodic horizon. Depth to bedrock is less than 20 inches (50 cm).

In some soils the spodic horizon is very low in iron. Such soils are properly classified as Lithic Cryohumods. In this publication, however, they are mapped as Lithic Cryorthods because they can be identified only by chemical analyses. See *133* in table 6.

Typic Cryandepts, very gravelly, hilly to steep, (10 percent) are well drained soils on the lower hillsides. The vegetation is mainly grasses and alder brush. Typi-

cally, the soils have very dark brown upper layers. They formed in shallow, silty volcanic ash over very gravelly loam or sandy loam. See *49b* in table 6.

Rough mountainous land (5 percent) consists of areas of bare rock and rubble on the peaks of a few sharp hills and ridges. It supports little or no vegetation. See *145* in table 6.

SO11—Humic Cryorthods, very gravelly, hilly to steep-Pergelic Cryofibrists, nearly level association is in the following major land resource areas:

	Acres
171 Alaska Peninsula and Southwestern Islands	185,000
175 Kuskokwim Highlands	101,000
Total	286,000

This association occupies mountain foot slopes and moraine hills in the vicinity of Iliamna Lake and Lake Clark (fig. 43). Many small streams, sloping valleys, and nearly level muskegs are included. Elevations range from about 50 to 2,000 feet (15 to 600 m) above sea level.

The dominant soils on foot slopes and moraines formed in very gravelly glacial till capped with a shallow mantle of silty volcanic ash. They support a forest of white spruce and paper birch or, on more gentle slopes, a dense forest of black spruce. On high ridgetops and slopes above tree line most of the soils are shallow over bedrock and support vegetation dominated by dwarf birch, other low shrubs, willow, alder, grasses, and mosses. In muskegs, which commonly occur in depressions and on valley bottoms between the hills, the soils consist of very poorly drained fibrous peat with a shallow permafrost table. The vegetation in these areas is dominantly sedges and mosses.

Though there are a few home gardens in the valleys, the principal soils of the association are not potentially suitable for cultivation and have severe limitations for most engineering uses. Primarily, the soils support

Figure 43.—Humic Cryorthods occupy hillsides under a forest of white spruce, black spruce, and paper birch. Pergelic Cryofibrists are in depressions and some valley floors. North of Nondalton.

natural vegetation and provide habitat for a variety of birds and mammals, including moose, caribou, and bear.

Principal components:

Humic Cryorthods, very gravelly, hilly to steep, (55 percent) are well drained soils on foot slopes and moraines under forests dominated by white spruce and paper birch on steeper slopes and by black spruce on more gentle slopes. They developed in silty volcanic ash about 10 to 24 inches (25 to 60 cm) thick over very gravelly glacial till. Typically, beneath a surface mat of partially decomposed organic matter, the soils have a thin, gray albic horizon and a spodic horizon 10 to 16 inches (25 to 40 cm) thick that is black or very dark reddish brown in the upper part and brown to yellowish brown in the lower part. In places the lower part of the spodic horizon extends into the very gravelly material. The soils are very strongly acid.

Many of these soils have spodic horizons that are very low in iron. Such soils are properly classified as Typic Cryohumods. Because separate identification is difficult without chemical analyses, they are mapped as Humic Cryorthods in this publication. See *131c* and *131d* in table 6.

Pergelic Cryofibrists, nearly level, (35 percent) consist of very poorly drained fibrous peat with shallow permafrost. They occupy nearly level muskegs in valleys and depressions in moraines. The vegetation is mainly sedges and mosses. Beneath a thick vegetative mat, the peat consists of dark brown, slightly decomposed fibers derived mostly from sedges and mosses. The permafrost table is usually less than 24 inches (60 cm) below the surface. See *28* in table 6.

Dystric Lithic Cryandepts, very gravelly, hilly to steep, (10 percent) are well drained soils that are shallow over bedrock. They occur on ridgetops. The dominant vegetation is dwarf birch, other low shrubs, willow, mosses, lichens, forbs, and grasses. Typically, the soils have very dark brown upper layers grading to yellowish brown or olive brown with depth. They formed in silty volcanic ash containing rock fragments. The ash is less than 20 inches (50 cm) thick over bedrock. The soils are strongly acid. See *53* in table 6.

SO12—Humic Cryorthods, very gravelly, hilly to steep-Terric Cryohemists, nearly level to steep association is in the following major land resource area:

	Acres
169 South Central Alaska Mountains	1,941,000

This association occupies mountain foot slopes, moraine hills, and deep glaciated valleys close to the north coast of the Gulf of Alaska (fig. 44). A few bare mountain peaks and narrow flood plains in valley bottoms are included. Elevations in most areas range from sea level to about 2,000 feet (600 m) on the upper parts of foot slopes.

The dominant soils in the association formed in very gravelly and stony glacial till under forests of Sitka spruce and western hemlock. Areas of very poorly drained peat covered with sedges, mosses, shrubs, and some western hemlock are common on many of the slopes affected by seepage and in areas of low rolling moraines (fig. 45). Because of mild winter temperatures and a heavy snow cover, the soils are seldom frozen.

The soils are not potentially suitable for cultivation and, largely because of steep slopes, most have severe limitations for structures and other engineering uses. Most of the areas are within National Forest boundaries. Though some of the soils support stands of commercial timber, logging in most places is limited by rugged terrain. Primarily, the soils provide wildlife habitat for species that frequent the coastal forests.

Principal components:

Humic Cryorthods, very gravelly, hilly to steep, (30 percent) are well drained soils on mountain foot slopes and moraines under forests dominated by Sitka spruce and western hemlock. Beneath a mat of partially decomposed forest litter, the soils have a gray albic horizon several inches thick over a spodic horizon about 16 to 20 inches (40 to 50 cm) thick that is black or reddish black in the upper part and grades to dark yellowish brown in the lower part. The soils formed in very gravelly and stony silt loam or loam till. They are very strongly acid. See *131a* in table 6.

Terric Cryohemists, nearly level to steep, (15 percent) are very poorly drained organic soils that occur on gentle to steep slopes affected by seepage. The vegetation is dominantly sedges, with a few western hemlock and shrubs. The soils are mainly partially decomposed dark brown sedge peat 16 to 50 inches (40 to 125 cm) thick over firm glacial till. The peat commonly contains woody fragments. Layers of fibrous moss peat and, in places, thin strata of buried volcanic ash are common. See *40* in table 6.

Terric Cryosaprists, nearly level to steep, (15 percent) consist of very poorly drained mucky peat in drainageways and on slopes affected by seepage. The vegetation is dominantly a forest of slow-growing western hemlock and Sitka spruce and a dense understory of shrubs and forbs. The peat consists mostly of highly decomposed, black finely divided organic material 16 to 50 inches (40 to 125 cm) thick over compact glacial till. See *43* in table 6.

Cryic Fragiaquods, very gravelly, hilly to steep, (15 percent) are poorly drained soils on slopes affected by seepage. They formed under forests dominated by western hemlock and, to a lesser extent, Sitka spruce. Typically, beneath a mat of partially decomposed forest litter, the soils have a mottled dark gray albic horizon and a mottled dark reddish brown spodic horizon 12 to 18 inches (30 to 45 cm) thick. Both horizons developed in very gravelly and stony glacial till. The substratum is very firm, slowly permeable till. See *114* in table 6.

Typic Cryohemists, nearly level to steep, (5 percent) consist of deep, very poorly drained peat on slopes of foothills and moraines. The vegetation is dominantly sedges and mosses. The peat is made up mainly of dark brown, partially decomposed sedge fibers interbedded with a few layers of moss fibers. In places, there are also a few buried layers of volcanic ash. The peat is more than 50 inches (125 cm) thick over glacial till and is wet throughout the year. See *37* in table 6.

Other components (20 percent):

Humic Lithic Cryorthods, very gravelly, hilly to steep, are well drained soils that have dark spodic horizons and are shallow over bedrock. They occur on

Figure 44.—**Humic Cryorthods under a Sitka spruce-western hemlock forest occupy moraine hills. Terric Cryohemists and other organic soils occur in sedge-covered swales and on slopes affected by seepage. Near Cordova.**

steep slopes at the higher elevations under a forest of Sitka spruce and western hemlock. See *132* in table 6.

Lithic Cryofolists, hilly to steep, are shallow, well drained soils consisting of forest litter over bedrock. They occur on steep slopes under a forest dominated by Sitka spruce and western hemlock. See *33* in table 6.

Typic Cryorthods, loamy, hilly to steep, are soils with thin albic and spodic horizons that occur on ridges above tree line. The vegetation is a dense mat of alpine shrubs and forbs. Bedrock is commonly 20 to 40 inches (50 to 100 cm) deep. See *121* in table 6.

Typic Cryorthods, sandy, hilly to steep, are soils with thin albic and spodic horizons that occur on stabilized dunes and terraces near flood plains. The vegetation is forest dominated by Sitka spruce. See *123a* in table 6.

Typic Sphagnofibrists, nearly level, are very poorly drained organic soils consisting mainly of coarse sphagnum moss fibers. They occur in depressions underlain by compact glacial till. The vegetation is dominantly sphagnum moss and low shrubs. See *30* in table 6.

Rough mountainous land consists of areas of bare rock on peaks and cliffs. It supports little or no vegetation. See *145* in table 6.

SO13—Humic Cryorthods, very gravelly, hilly to steep-Rough mountainous land association is in the following major land resource areas:

	Acres
170 Cook Inlet-Susitna Lowland	119,000
173 Alaska Range	624,000
175 Kuskokwim Highlands	776,000
Total	1,519,000

This association occupies alpine ridges, benches, and foot slopes close to high mountains of the Alaska Range

Figure 45.—**Terric Cryohemists and other organic soils occupy rolling moraines at low elevations. Hawkins Island, near Cordova.**

in south central Alaska and in parts of the Kilbuck Mountains west of the Wood River and Tikchik Lakes. Many of the areas are dissected by deep glaciated valleys. Elevations in most areas are between 1,000 and 3,000 feet (300 and 900 m), but extreme elevations range from about 100 feet (30 m) in a few valley bottoms to 5,000 feet (1,500 m) on included peaks. Bedrock is exposed on many of the steep slopes and ridgetops above 3,000 feet (900 m), but on most other slopes it is covered with very gravelly glacial till or colluvium capped with a thin mantle of silty volcanic ash.

The soils are free of permafrost except for those on directly north-facing slopes, in poorly drained valley bottoms, and on the upper slopes of high ridges. The vegetation on well drained soils below 3,000 feet (900 m) is principally alder and grasses. Some well drained soils at lower elevations support a few stunted white spruce. At higher elevations most of the soils support alpine shrubs, short grasses, lichens, and forbs. Poorly drained soils with permafrost that occupy north-facing slopes, high swales, and valley bottoms are generally covered with mosses, sedges, and low shrubs.

In general, the principal soils of the association are not potentially suitable for cultivation or forestry and have severe limitations for engineering uses. Primarily, they provide habitat for a variety of birds and mammals, including moose, bear, wolves, and, in places, a few caribou.

Principal components:

Humic Cryorthods, very gravelly, hilly to steep, (40 percent) are well drained soils without permafrost that formed in a thin mantle of silty volcanic ash over very gravelly and stony material. They occur on foot slopes of high ridges, under vegetation that is mainly alder and grasses. Typically, beneath a surface mat of partially decomposed organic material, the soils have a

thin, gray silt loam albic horizon over a spodic horizon about 12 to 18 inches (30 to 45 cm) thick. The spodic horizon is black or very dark reddish brown silt loam in the upper part and dark brown to yellowish brown in the lower part, which commonly extends into very gravelly and stony glacial till or colluvium. The soils are very strongly acid. In places on steep slopes they are underlain by bedrock at 20 to 40 inches (50 to 100 cm). See *131b* and *131d* in table 6.

Rough mountainous land (25 percent) consists of areas of bare rock and stony rubble on high ridges and mountains. It supports little vegetation other than lichens and a few scattered alpine plants. See *145* in table 6.

Pergelic Cryaquepts, very gravelly, hilly to steep, (20 percent) are poorly drained soils with permafrost that occur on directly north-facing slopes and in swales on high ridges. The vegetation is dominantly sedges, mosses, and low shrubs. Beneath a thin peaty surface mat, the soils consist of mottled dark gray silt loam over dark gray very gravelly and stony loam. The permafrost is usually less than 24 inches (60 cm) below the surface. See *76* in table 6.

Lithic Cryumbrepts, very gravelly, hilly to steep, (10 percent) are shallow well drained soils on high alpine slopes and ridges. The vegetation is mainly low shrubs, grasses, and forbs. Typically, beneath a surface mat of partially decomposed organic material, the soils have a very dark brown upper horizon formed in very gravelly silt loam or sandy loam that is less than 20 inches (50 cm) thick over bedrock. Though the mean annual soil temperature is below freezing, the material above the bedrock is free of ice-rich permafrost. See *97* in table 6.

Other components (5 percent):

Pergelic Cryorthents, very gravelly, hilly to steep, are gray soils on high ridges under a sparse cover of low alpine plants. See *20* in table 6.

Typic Cryorthods, very gravelly, hilly to steep, are soils with thin albic and spodic horizons on a few low foot slopes. The vegetation is commonly a sparse forest of stunted white spruce. See *125b, 125c,* and *125d* in table 6.

Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling, are poorly drained soils with a thick peaty surface mat on valley bottoms under a vegetative cover dominated by sedge tussocks and low shrubs. See *68* in table 6.

Lithic Cryorthods and Lithic Cryohumods, very gravelly, hilly to steep, have thin albic horizons and black to dark reddish brown spodic horizons. They occur in association with Humic Cryorthods on foot slopes. They are less than 20 inches (50 cm) thick over consolidated bedrock. See *134* and *118* in table 6.

SO14—Pergelic Cryorthods-Pergelic Cryaquepts, sandy, nearly level to rolling association is in the following major land resource area:

	Acres
176 Interior Alaska Highlands	188,000

This association occupies a broad, partially forested undulating area of low stabilized sand dunes in the Kobuk River Valley (fig. 46). Elevations in most of the area are near 600 feet (180 m) above sea level.

The soils formed in thick deposits of eolian sand capped in places with a very thin mantle of silty loess. On the dunes the principal soils are excessively drained and support a sparse forest of stunted aspen and white spruce and a thin ground cover of lichens, mosses, and low shrubs. In swales between the dunes the dominant soils are poorly drained and are covered mainly with mosses and sedges. Though all of the soils have mean annual temperatures below freezing, only the poorly drained soils in swales have ice-rich permafrost within 40 inches (100 cm) of the surface. None of the soils are potentially suitable for cultivation or forestry, but the excessively drained soils have only slight or moderate limitations for buildings, roads, and other structures.

Principal components:

Pergelic Cryorthods, sandy, nearly level to rolling, (45 percent) are excessively drained soils on low undulating and rolling stabilized dunes under a forest of stunted white spruce and aspen. Beneath a thin mat of mosses, lichens, and partially decomposed organic material, the soils have a very thin, gray albic horizon and a brown to yellowish brown spodic horizon about 6 to 12 inches (15 to 30 cm) thick. The soils developed in 5 to 16 inches (12 to 40 cm) of silt loam or sandy loam loess over deep fine sand. Though the mean annual temperature is below freezing the soils seldom retain enough moisture for the formation of ice-rich permafrost. See *135* in table 6.

Pergelic Cryaquepts, sandy, nearly level to rolling, (40 percent) are poorly drained soils with permafrost that occur in nearly level swales between dunes. The vegetation is mainly sedges, mosses, and low shrubs. Typically, beneath a thin peaty surface layer, the soils consist of mottled dark gray silt loam or sandy loam 10 to 20 inches (25 to 50 cm) thick over gray fine sand. The permafrost table is usually 20 to 30 inches (50 to 75 cm) below the mineral surface. See *74* in table 6.

Pergelic Cryopsamments, sandy, nearly level to rolling, (15 percent) are excessively drained soils on the crests of low stabilized dunes under sparse forests of aspen and white spruce. Typically, beneath a thin surface mat of partially decomposed organic matter, the soils consist of grayish brown or olive brown fine sand or loamy fine sand. Though the mean annual soil temperature is below freezing, the soils do not retain sufficient moisture for the formation of ice-rich permafrost. See *23* in table 6.

SO15—Pergelic Cryorthods-Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling association is in the following major land resource areas:

	Acres
171 Alaska Peninsula and Southwestern Islands	18,000
172 Copper River Plateau	457,000
173 Alaska Range	109,000
174 Interior Alaska Lowlands	366,000
175 Kuskokwim Highlands	138,000
Total	1,088,000

This association occupies low moraine hills and broad intervening valleys near the Alaska Range in the Copper River Plateau, the upper Kuskokwim Valley, and areas west of Lake Clark. Lakes, streams, and small outwash plains are also common features of the landscape. Elevations range from about 1,500 to 3,000 feet (450 to 900 m) above sea level.

Figure 46.—Pergelic Cryorthods occupy forested stabilized dunes. Sandy Pergelic Cryaquepts occur in swales. Active dunes border the area. Kobuk River Valley.

Most of the soils formed in gravelly glacial drift that is commonly capped with a thin mantle of silty loess or volcanic ash. The dominant vegetation is tundra, but some of the soils support scattered forests of stunted white spruce, aspen, and paper birch, or stands of black spruce.

The soils are not potentially suitable for cultivation or forestry, and the poorly drained soils with permafrost have severe limitations for roads, buildings, and other structures. In general, the best sites for construction are on the well drained very gravelly soils on moraines and stream terraces. The association is useful mainly as habitat for a variety of wildlife, including moose, caribou, bear, birds, and many small mammals.

Principal components:

Pergelic Cryorthods, very gravelly, nearly level to rolling, (35 percent) are well drained soils on low moraines and outwash plains. The dominant vegetation is mainly tundra shrubs, grasses, mosses, lichens, and forbs, but some of the soils support sparse forests of stunted white spruce, aspen, and paper birch. Typically, the soils have a thin albic horizon over a reddish brown to brown spodic horizon 6 to 12 inches (15 to 30 cm) thick. They formed in about 10 to 20 inches (25 to 50 cm) of loamy material over very gravelly glacial drift. Though the mean annual soil temperature is below freezing, most of the soils do not retain sufficient moisture for the formation of ice-rich permafrost. See *136* in table 6.

Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling, (25 percent) are poorly drained soils with a shallow permafrost table that occur on foot slopes and in valleys under a cover of mosses, sedges, low shrubs, and scattered forests of black spruce. Typically, the soils have a thick peaty surface layer over mottled gray silt loam or gravelly silt loam underlain by very gravelly glacial drift or colluvium. The soils are usually wet during summer, and ice-rich permafrost is usually less than 20 inches (50 cm) below the surface mat. See *68* in table 6.

Pergelic Cryofibrists, nearly level, (10 percent) are

very poorly drained organic soils in depressions and shallow basins in moraines and terraces. The organic material is made up of dark brown fibers derived mainly from sedges and mosses. Ice-rich permafrost is usually less than 20 inches (50 cm) below the surface. See *28* in table 6.

Pergelic Cryorthods, very gravelly, hilly to steep, (10 percent) are well drained soils on a few choppy moraine hills under either a cover of low shrubs, mosses, lichens, and grasses or a sparse forest of stunted white spruce and quaking aspen. Typically, the soils have a thin, gray albic horizon and a reddish brown spodic horizon 6 to 12 inches (15 to 30 cm) thick that developed in a few inches of loamy material over very gravelly and sandy glacial drift. Though the mean annual soil temperature is below freezing, the soils do not retain enough moisture in the gravelly material for the formation of ice-rich permafrost. See *137* in table 6.

Pergelic Cryumbrepts, very gravelly, nearly level to rolling, (10 percent) are well drained soils commonly on the tops of broad smooth hills and ridges. The vegetation is tundra dominated by shrubs, mosses, lichens, grasses, and forbs. Typically, beneath a thin surface mat of partially decomposed organic material, the soils have a very dark brown loamy surface layer 8 to 12 inches (20 to 30 cm) thick over grayish brown or olive brown very gravelly glacial drift. The soils have a mean annual temperature below freezing, but lack solidly frozen material. See *99* in table 6.

Other components (10 percent):

Pergelic Cryorthents, very gravelly, hilly to steep, are gray soils on a few high hills and ridges under a cover of tundra shrubs, grasses, mosses, and lichens. See *20* in table 6.

Pergelic Cryaquepts, very gravelly, nearly level to rolling, are poorly drained soils that occupy gentle swales and drainageways. The vegetation is mainly sedges, mosses, and low shrubs. The permafrost table is less than 24 inches (60 cm) below the surface. See *75* in table 6.

Pergelic Cryochrepts, very gravelly, hilly to steep, are well drained soils with brown upper horizons. They occur on a few choppy moraine hills. The vegetation is tundra shrubs, grasses, mosses, and forbs. See *93* in table 6.

Lithic Cryorthods, very gravelly, hilly to steep, are soils with thin albic and spodic horizons on a few steep slopes of sharp ridges under a cover of shrubs, short grasses, lichens, and mosses. They are less than 20 inches (50 cm) deep over bedrock. See *134* in table 6.

SO16—Pergelic Cryorthods, very gravelly, hilly to steep-Histic Pergelic Cryaquepts, loamy, nearly level to rolling association is in the following major land resource area:

	Acres
172 Copper River Plateau	2,626,000

This association is extensive on foothills adjoining the Alaska Range in northern parts of the Copper River Plateau (fig. 47). Choppy moraine hills with broad intervening valleys, high ridges with long foot slopes, small outwash plains, many lakes, streams, and scattered muskegs are major features of the landscape. Elevations range from about 2,500 to 4,500 feet (750 to 1,350 m) above sea level. Solifluction lobes pattern some of the foot slopes, and frost-scarred soils are common on ridges at higher elevations.

The dominant soils formed in glacial till or loamy colluvial sediments, and most are covered with tundra vegetation. Dwarf birch, other low shrubs, mosses, lichens, short grasses, and forbs are the principal plants on well drained soils, but sparse forests of white spruce occur at lower elevations. The vegetation on poorly drained soils that have a shallow permafrost table is mainly sedge tussocks, mosses, low shrubs, and scattered forests of black spruce.

In general, soils of the association are not potentially suitable for cultivation or commercial forestry, and many also have severe limitations for roads and structures. Well drained soils on terraces and low rolling moraines, however, usually have only slight or moderate limitations for construction. Most of the soils provide habitat suitable for caribou, moose, and a wide variety of small mammals and birds.

Principal components:

Pergelic Cryorthods, very gravelly, hilly to steep, (35 percent) are well drained soils on hilly moraines. The vegetation is dominantly dwarf birch, other low shrubs, mosses, grasses, lichens, and patches of stunted white spruce. Slip scars and a lobate surface pattern are common. Beneath a thin surface of partially decomposed organic material, the soils have two sequences of thin, gray albic horizons and reddish brown spodic horizons developed in shallow silt loam over very gravelly loam or sandy loam. Though the mean annual soil temperature is below freezing, the very gravelly material does not normally contain lenses of clear ice. See *137* in table 6.

Histic Pergelic Cryaquepts, loamy, nearly level to rolling, (25 percent) are poorly drained soils with a shallow permafrost table in valleys and on long foot slopes. Solifluction lobes are common. The vegetation is mainly sedge tussocks, mosses, low shrubs, and, in places, stands of stunted black spruce. Typically, the soils have a thick peaty surface mat over mottled gray or dark gray, frost-churned loam or silt loam. Depth to perennially frozen material is usually less than 20 inches (50 cm) below the surface mat. See *65a* in table 6.

Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling, (10 percent) are very poorly drained soils with a shallow permafrost table in broad depressions in outwash plains. The vegetation is a cover of low shrubs, mosses, sedges, and scattered black spruce. Beneath a thick peaty surface mat the soils consist of mottled gray gravelly silt loam that is shallow over very gravelly sediment. The permafrost table is usually less than 20 inches (50 cm) below the peaty surface mat. See *68* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, (10 percent) are well drained soils on high ridgetops under a cover dominated by low shrubs, short grasses, lichens, and forbs. The soils have a very dark brown gravelly silt loam upper layer about 8 to 12 inches (20 to 30 cm) thick over very gravelly and stony loam or sandy loam. This material is commonly underlain by bedrock at depths of 20 to 40 inches (50 to 100 cm). The mean annual soil temperature is below freezing,

Figure 47.—**Pergelic Cryorthods occupy most areas above tree line, including slopes with irregular lobate pattern. Histic Pergelic Cryaquepts are in lower areas under black spruce, willows, and dwarf birch. North of Crosswind Lake.**

but ice-rich permafrost, if present, is very deep. See *100* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, (5 percent) are well drained soils on the tops of ridges and high moraine hills. The vegetation is a sparse cover of low shrubs and tundra plants. Beneath a thin mat of partially decomposed organic material, the soils consist of grayish brown very gravelly loam or sandy loam that is commonly underlain by bedrock. The mean annual soil temperature is below freezing, but ice-rich permafrost, if present, is deep. See *20* in table 6.

Pergelic Cryofibrists, nearly level, (5 percent) are very poorly drained organic soils in scattered depressions in moraines and terraces. The vegetation is mainly mosses, sedges, and low shrubs. Beneath a mat of live moss and roots the peat consists of coarse dark brown fibers derived from sedges and mosses. The permafrost table is shallow, and during the summer the peat is constantly wet. See *28* in table 6.

Other components (10 percent):

Pergelic Cryaquepts, very gravelly, hilly to steep, are poorly drained soils with permafrost in steep drainageways under a cover of sedges, mosses, and low shrubs. See *76* in table 6.

Pergelic Cryorthods, very gravelly, nearly level to rolling, are well drained shallow soils with thin albic and spodic horizons on terraces. The vegetation is dwarf birch, other low shrubs, mosses, grasses, and scattered stands of white spruce. See *136* in table 6.

Lithic Cryumbrepts, very gravelly, hilly to steep, are well drained soils with a dark upper horizon. They are shallow over bedrock. They occur on high hills and ridgetops under a sparse cover of low shrubs, grasses, and forbs. See *97* in table 6.

Rough mountainous land consists of areas of bare rock, rockslides, and shallow soils on a few sharp peaks. Some areas are sparsely vegetated with lichens, mosses, and grasses. See *145* in table 6.

SO17—Pergelic Cryorthods, very gravelly, hilly to steep-Rough mountainous land association is in the following major land resource areas:

	Acres
172 Copper River Plateau	402,000
173 Alaska Range	1,130,000
175 Kuskokwim Highlands	566,000
Total	2,098,000

This association occupies alpine areas adjoining steep mountains in the Alaska Range. High sharp ridges and peaks of bare rock or rubble, steep mountainsides, and deep glaciated valleys dominate the landscape. Elevations generally range from about 2,000 to 6,000 feet (600 to 1,800 m).

Most of the soils formed in very gravelly and stony colluvium or glacial drift under a cover of alpine tundra vegetation. Although the mean annual soil temperature is below freezing, the soils do not usually retain enough moisture for the formation of lenses of clear ice.

Soils of the association are not potentially suitable for cultivation or forestry and have severe limitations for most engineering uses. Primarily, they provide wildlife habitat for species that frequent alpine areas.

Principal components:

Pergelic Cryorthods, very gravelly, hilly to steep, (30 percent) are well drained soils on mountainsides and ridges close to tree line. The vegetation is dominantly a cover of alpine shrubs, grasses, and forbs. Typically, the soils have a thin, gray albic horizon and a reddish brown spodic horizon about 8 to 12 inches (20 to 30 cm) thick that developed in very gravelly and stony silt loam or sandy loam. Bedrock is commonly 20 to 40 inches (50 to 100 cm) below the surface. The mean annual soil temperature is below freezing. See *137* in table 6.

Rough mountainous land (30 percent) consists of areas of bare rock and stony rubble on high sharp peaks and ridges. Although most areas are unvegetated, a few patches of shallow soils support a sparse cover of alpine tundra plants. See *145* in table 6.

Histic Pergelic Cryaquepts, very gravelly, hilly to steep, (15 percent) are poorly drained soils on north-facing slopes and in valley bottoms. The vegetation is mainly sedge tussocks, mosses, and low shrubs. Beneath a thick peaty surface mat the soils consist of mottled gray frost-churned very gravelly loam to sandy loam that is perennially frozen below depths of 10 to 20 inches (25 to 50 cm). See *69* in table 6.

Pergelic Cryorthents, very gravelly, hilly to steep, (15 percent) are well drained soils on slopes and ridges above tree line under a cover of alpine shrubs, mosses, lichens, grasses, and forbs. Typically, beneath a thin surface mat of partially decomposed organic material, the soils consist of grayish brown very gravelly and stony loam or sandy loam that is commonly 20 to 40 inches (50 to 100 cm) thick over bedrock. The mean annual soil temperature is below freezing. See *20* in table 6.

Pergelic Cryumbrepts, very gravelly, hilly to steep, (10 percent) are well drained, frost-scarred soils on high hills and ridges above tree line. The dominant vegetation is low shrubs, grasses, mosses, lichens, and forbs. Typically, the soils have a very dark brown gravelly silt loam upper horizon 6 to 10 inches (15 to 25 cm) thick over very gravelly and stony loam or sandy loam. They are commonly underlain by bedrock at depths of 20 to 40 inches (50 to 100 cm). The mean annual soil temperature is below freezing. See *100* in table 6.

SO18—Humic Lithic Cryorthods-Humic Cryorthods, very gravelly, hilly to steep association is in the following major land resource areas:

	Acres
168 Southeastern Alaska	9,915,000
169 South Central Alaska Mountains	76,000
Total	9,991,000

This association occupies steep hills and isolated low mountains on islands and parts of the mainland in southeastern Alaska. Elevations range from sea level to about 3,000 feet (900 m). On some of the islands and on the mainland the association borders high mountains and glaciers.

The entire area was formerly covered by glaciers and exhibits features typical of glaciated landscapes, including U-shaped valleys and moraine deposits on lower slopes of hills and in valleys. Higher and steeper slopes have bedrock close to the surface and have many rock outcrops. Tops of the ridges are less steeply sloping, except for a few high rocky peaks.

Most of the area is covered by a forest dominated by western hemlock, Sitka spruce, and, in the southern part, redcedar. Many areas on lower slopes subject to seepage and in valley bottoms support mosses, sedges, and other plants of muskegs. The tree line is at an elevation of about 2,000 feet (600 m). The vegetation above tree line is dominated by sedges, mosses, and alpine forbs and shrubs.

Soils under the forest have a wide range of properties. They include well drained to poorly drained mineral soils in positions ranging from steep hillsides to level terraces along streams and organic soils on lower slopes. Organic soils occupy most treeless areas, including those above tree line.

Except for small gardens, most of the area is too steep or too wet for crops. The forested slopes produce large volumes of timber, and logging is a major industry in the area. Steep slopes, highly erodible mineral soils, continually wet organic soils, and flooding in lowlands are severe limitations for most kinds of construction. The most suitable soils in the area for construction are well drained soils on narrow terraces bordering streams and on rolling moraines.

Principal components:

Humic Lithic Cryorthods, very gravelly, hilly to steep, (15 percent) are well drained soils on very steep forested hillsides. They are most common on steep slopes above moraine deposits at lower elevations, but in places they also occur close to sea level. The soils support a forest of Sitka spruce, western hemlock, and cedar. Under a thick mat of forest litter they have a thin gray albic horizon and a black to dark reddish brown spodic horizon. Both horizons formed in very gravelly silty loam. The spodic horizon is highly thixotropic. The soils are normally very strongly acid. Consolidated bedrock is at a depth of 5 to 20 inches (12

to 50 cm) below the base of the forest litter. Outcrops of bare rock are common. In many places the soils are closely associated with Lithic Cryofolists. See *132* in table 6.

Humic Cryorthods, very gravelly, hilly to steep, (15 percent) are well drained soils in glacial till, usually on the lower sides of steep hills. They support a forest of Sitka spruce, western hemlock, and cedar. Beneath a thick mat of forest litter the soils have a thin, gray albic horizon and a thick, highly thixotropic spodic horizon that may extend to depths of 3 feet (90 cm) or more. The upper part of the spodic horizon is black, and colors grade through dark reddish brown and dark brown to olive or olive brown in the underlying material. Thin seams of organic matter deposited from percolating water are common in the lower part of the spodic horizon and in the underlying material. The texture is very gravelly silt loam in all horizons. The soils are normally extremely acid near the surface, but become less strongly acid with depth. Where the till is derived from calcareous material, the lower part of the soil may be nonacid. In places the deposit of glacial till is thin, and consolidated bedrock occurs at depths as shallow as 20 inches (50 cm). See *131a* in table 6.

Cryic Fragiorthods, very gravelly, hilly to steep, (10 percent) are moderately well drained soils on steep moraine hills. They support a forest dominated by Sitka spruce and western hemlock. Soil characteristics are like those of the Humic Cryorthods except that a thick fragipan underlies the spodic horizon, beginning at depths of 15 to 40 inches (40 to 100 cm). The presence of this slowly permeable substratum increases the likelihood of soil slippage, and areas of Cryic Fragiorthods characteristically are marked by landslides. Textures range from very gravelly sandy loam to very gravelly silt loam. These soils are most prevalent on Prince of Wales Island, but occur as scattered areas throughout the association. See *139* in table 6.

Typic Cryohemists, nearly level to steep, (10 percent) are very poorly drained organic soils on lower hillsides. They consist of partially decomposed peat derived principally from sedges. Layers of moss peat also occur, especially in the upper part of the soil. The peat is underlain at depths of more than 4 feet by compact glacial till. Slopes are gentle to moderately steep, but the soils are nearly always completely saturated. Sedges and mosses are the dominant plants, but in many places the soils support a sparse stand of lodgepole pine and cedar. See *37* in table 6.

Terric Cryosaprists, nearly level to steep, (10 percent) are poorly drained organic soils on slopes subject to seepage, usually in association with Typic Cryohemists and Cryic Fragiaquods. They consist of 16 to 40 inches (40 to 100 cm) of highly decomposed organic matter over a substratum of firm very gravelly glacial till. Woody fragments occur commonly in the organic material and may make up as much as 20 percent of its volume. The soils support a forest dominated by cedar and hemlock and a lesser amount of Sitka spruce. They are very strongly acid. See *43* in table 6.

Lithic Cryofolists, hilly to steep, (10 percent) are well drained organic soils on steep slopes with many rock outcrops, usually in association with Lithic Humic Cryorthods. They consist of 6 to 20 inches (15 to 50 cm) of forest litter resting directly on bedrock or on a very thin gravelly horizon above the bedrock. In general, they are extremely acid. The soils support a western hemlock-Sitka spruce forest. See *33* in table 6.

Cryic Fragiaquods, very gravelly, hilly to steep, (5 percent) are somewhat poorly drained soils on lower hillsides that are subject to seepage. They support a forest dominated by cedar and western hemlock. The soils have a thin, mottled albic horizon over a black to dark brown spodic horizon. The spodic horizon is underlain by a very firm gravelly or stony olive gray fragipan at depths of 6 to 20 inches (15 to 50 cm). Seep water flows above this layer almost continually. Textures range from very gravelly loam to very gravelly silt loam. The soils are closely associated with Terric Cryosaprists, which also overlie a very firm substratum. See *114* in table 6.

Typic Sphagnofibrists, nearly level to rolling, (5 percent) are very poorly drained organic soils that mainly occupy nearly level to moderately sloping benches and depressions at lower elevations and in places completely cover low rolling moraine hills. They consist of very strongly acid sphagnum moss peat with layers of fibrous sedge peat. Thickness of the peat ranges from 5 to as much as 50 feet (1.5 to 15 m). In many areas the surface of the peat bog is domed, with the center of the bog considerably higher than the edges. The substratum is usually glacial till. On low rolling hills a thin placic horizon commonly occurs at or near the top of the mineral substratum.

Most areas of these soils support only mosses, sedges, and low forbs and shrubs. Small ponds are common. In places there are stands of stunted lodgepole pine. See *30* in table 6.

Lithic Cryohemists, hilly to steep, (5 percent) are poorly drained organic soils that are extensive in areas above tree line. They consist of partially decomposed sedge peat 10 to 40 inches (25 to 100 cm) thick over bedrock. The lowest part of the peat, just over the bedrock, may be highly decomposed, and a thin layer of mineral soil may occur between the peat and the consolidated rock. The soils are almost always completely saturated. In the winter the snow cover is very thick and the soils probably do not freeze. The vegetation is dominantly sedges and minor amounts of sphagnum moss, deer cabbage, and other forbs and shrubs. See *38* in table 6.

Lithic Cryosaprists, hilly to steep, (5 percent) are highly decomposed organic soils above tree line and on steep forested slopes, commonly close to the tree line. The vegetation in areas above tree line is dominantly low shrubs and forbs and occasional clumps of nearly prostrate mountain hemlock. Below tree line the soils support a slow-growing forest dominated by mountain hemlock and Alaska cedar. The soils consist of a thin surface layer of partially decomposed peat and 5 to 30 inches (12 to 75 cm) of black finely divided organic material over consolidated bedrock. They are almost always saturated. In winter the snow cover is very thick, and the soils probably do not freeze. See *42* in table 6.

Other components (10 percent):

Lithic Cryaquods, very gravelly, hilly to steep, are somewhat poorly drained soils principally on high forested slopes subject to seepage from areas of organic

soils above tree line. They also occur in a few places at low elevations. They support a forest dominated by mountain and western hemlock and some cedar. See *109* in table 6.

Humic Cryorthods, very gravelly, nearly level, are well drained soils on narrow terraces in valley bottoms subject to occasional flooding. They formed in stratified loamy and sandy material over a substratum of very gravelly sand. They support a Sitka spruce forest. See *130* in table 6.

Typic Cryaquents, loamy, nearly level, are poorly drained soils in tidal marshes and meadows at the mouths of valleys. They vary in texture and color, but generally consist of mottled sandy and silty material with lenses of buried organic matter. They are covered by grasses, sedges, and other plants of coastal meadows. See *2a* in table 6.

Fluvaquentic Cryofibrists, nearly level, are very poorly drained organic soils that occupy marshes in valley bottoms. They consist of fibrous sedge peat with lenses of mineral soil within the peat. The vegetation is dominantly sedges. See *27* in table 6.

Soil interpretations for land use planning

This section contains information about the suitability and limitations of the soils for selected uses. These evaluations, based largely on soil properties and related factors, are designed to aid resource managers, land use planners, engineers, biologists, foresters, and others who require estimates of the relative potentials of the soils for specific uses. In table 6, map unit components are rated according to their general suitability or limitations for a number of selected uses. One or two of the principal reasons are indicated for any adverse rating.

The soil interpretations, combined with information given in the descriptions of the soils and map units, can be applied in broad land use planning in estimating the effects of a specific use or alternative uses on the soils and the overall environment. Soils with the highest potential for a specific use can be identified. Soils with unfavorable properties can often be avoided. The evaluations are also useful in planning and implementing conservation measures that may be required to prevent environmental damage. Engineers may use them in preliminary planning of routes for highways or similar projects (fig. 48) and in identifying some of the general problems likely to be encountered in construction.

In using this exploratory survey it is important to understand that the soils are not so precisely defined as in more detailed soil surveys and that the range of properties within each identified soil component of the map units is relatively wide. For this reason the information can be applied only in a general way to large geographical areas and may not be valid for small areas or specific sites. Detailed soil surveys in which the soils are more precisely defined and are delineated on large-scale maps are required for planning in small areas.

Soil suitability and limitation ratings are estimated only for phases of soil subgroups, that is, the individual components of the map units. Ratings are *not* made for the map units as a whole. It is necessary to determine from the descriptions of the map units the kind and proportionate extent of the component soils and the position on the landscape that each component occupies. It is then possible, with the aid of a detailed topographic map or by inspection, to locate the parts of a map unit to which any particular rating applies. By combining the interpretive information for all of the components, general suitabilities and limitations for the entire unit can usually be estimated.

Interpretations and evaluations are based mainly on the most commonly occurring characteristics of each identified soil. For example, loamy texture, as defined in this survey, can range from sandy loam to silty clay loam and the loamy material from 25 inches (62 cm) to many feet thick over sand, gravel, glacial till, or shattered bedrock. Similarly, hilly to steep soils can range in gradient from 12 to more than 45 percent. Generally, however, the range is narrower. It should also be recognized that soils with properties other than those of the dominant soils may be included with any identified component of a map unit.

In the following section each of the specific uses for which ratings were made is summarized, and the criteria used in determining the ratings are described. The estimated acreage of map units in major land resource areas with each rating is listed in table 7.

Common crops

Only a very small proportion of the total acreage of soils potentially suitable for crops in Alaska is under cultivation. Extensive areas of these soils are on nearly level to rolling plains in the Interior Alaska Lowlands and Cook Inlet-Susitna Lowland and in broad valleys and rolling uplands of the Kuskokwim Highlands and Interior Alaska Highlands. Though the proportionate extent of these soils is small as compared with the area of the State, the total acreage is significant.

Most farming is concentrated in the Cook Inlet-Susitna Lowland and, to a lesser extent, in the Tanana Valley of the Interior Alaska Lowlands. Barley (fig. 49), oats, grasses for hay (fig. 50) and silage, and potatoes are the principal farm crops. Cabbage, lettuce, carrots, celery, cauliflower, brussel sprouts, broccoli, turnips, peas, strawberries, and raspberries are some of the vegetables and small fruits grown in small farms and gardens for local markets and home use. Such crops as tomatoes and cucumbers are generally grown in greenhouses. Ornamental shrubs, flowers, and other plants are produced in nurseries, especially near the larger population centers.

The potential suitability for farming of each identified soil, or map unit component, is estimated in table 6 under the heading "Common crops." The principal crops grown in Alaska—barley, oats, grasses for hay and silage, and potatoes—were considered in preparing the ratings. Although only these crops were used, it is assumed that the ratings are also valid for vegetables and other crops suited to Alaskan soils. Soils were rated good, fair, poor, or unsuited on the following basis:

Good. Soil or climate limitations, if any, are easily overcome, and all of the common Alaskan crops

TABLE 6.—*Suitability and limitation ratings of*

Map unit component and major land resource area (MLRA) [2]	Suitability ratings [1]		
	Common crops	Rangeland	
		Cattle and sheep	Reindeer
ENTISOLS			
1. Typic Cryaquents, clayey, nearly level	Poor: WET, FLD	Poor: WET, LPR	Poor: LPR
2. Typic Cryaquents, loamy, nearly level:			
a. MLRA 168, 169, 170	Poor: WET, FLD	Fair to poor: WET, LPR.	Poor: LPR
b. MLRA 175, 177, 178	Poor: WET, FLD	Poor: WET, LPR	Fair: LPR
3. Typic Cryaquents, sandy, nearly level:			
a. MLRA 168, 169, 170	Poor: WET, FLD	Fair to poor: WET, LPR.	Poor: LPR
b. MLRA 172, 175, 178	Poor: WET, FLD	Poor: WET, LPR	Fair: LPR
4. Typic Cryaquents, very gravelly, nearly level to rolling	Poor: WET, FLD	Poor: WET, LPR	Poor: LPR
5. Typic Cryaquents, very gravelly, hilly to steep	Poor: SLP, WET	Poor: FOR, WET	Unsuited: LPR
6. Andaqueptic Cryaquents, loamy, nearly level	Poor: WET, FLD	Fair: WET	Fair: LPR
7. Typic Cryofluvents, loamy, nearly level to rolling:			
a. MLRA 168, 169, 170, 174, 175, 176	Good	Poor: FOR	Poor: LPR
b. MLRA 172	Fair: SFP, FLD	Poor: FOR, SFP	Poor: LPR
c. MLRA 173, 177, 178	Poor: LTP	Unsuited: SFP	Fair: LPR
d. MLRA 180, 181	Unsuited: SFP	Unsuited: SFP	Fair: LPR
8. Typic Cryofluvents, very gravelly, nearly level:			
a. MLRA 168	Fair: FLD	Poor: FOR	Unsuited: LPR
b. MLRA 169, 170, 174	Fair: DRT, FLD	Poor: FOR	Poor: LPR
c. MLRA 175	Fair: DRT, FLD	Poor: FOR, SFP	Poor: LPR
9. Typic Cryorthents, clayey, nearly level to rolling	Poor: SFP	Poor: FOR, SFP	Fair: LPR
10. Typic Cryorthents, loamy, nearly level to rolling:			
a. MLRA 170, 174, 175, 176	Good	Poor: FOR	Poor: LPR
b. MLRA 169, 172, 173	Fair: SFP, ERO	Poor: FOR, SFP	Fair: LPR
c. MLRA 177, 180	Poor: SFP	Unsuited: SFP	Fair: LPR
11. Typic Cryorthents, loamy, hilly to steep	Poor: SLP, ERO	Poor: FOR	Fair to poor: LPR
12. Typic Cryorthents, very gravelly, nearly level to rolling:			
a. MLRA 168, 169, 170, 174, 175, 176	Fair to poor: DRT, STN.	Poor: FOR	Fair to poor: LPR
b. MLRA 172, 173	Poor: DRT, SFP	Poor: FOR	Fair: LPR
c. MLRA 178, 181	Unsuited: LTP	Poor: LPR, SFP	Good
13. Typic Cryorthents, very gravelly, hilly to steep:			
a. MLRA 168	Unsuited: SLP, STN.	Poor: FOR	Unsuited: LPR
b. MLRA 169, 170	Poor to unsuited: SLP, STN.	Poor: FOR	Poor: LPR
c. MLRA 173, 174, 175, 176	Poor to unsuited: SLP, STN.	Poor to unsuited: FOR, SFP.	Fair: LPR
14. Andeptic Cryorthents, very gravelly, nearly level to rolling	Unsuited: STN	Good	Fair: LPR
15. Aquic Cryorthents, very gravelly, hilly to steep	Unsuited: SFP, STN.	Unsuited: SFP, SGR	Good
16. Lithic Cryorthents, very gravelly, hilly to steep	Unsuited: SFP, BDR.	Unsuited: SFP, SGR	Fair: SGR
17. Pergelic Cryorthents, clayey, nearly level to rolling	Unsuited: SFP	Unsuited: SFP	Good
18. Pergelic Cryorthents, loamy, nearly level to rolling	Unsuited: SFP	Unsuited: SFP	Good
19. Pergelic Cryorthents, very gravelly, nearly level to rolling	Unsuited: SFP	Unsuited: SFP	Good
20. Pergelic Cryorthents, very gravelly, hilly to steep	Unsuited: SFP	Unsuited: SFP	Fair: SGR

map unit components for selected uses

Suitability ratings[1]—Continued	Limitation ratings[1]			
Commercial forestry	Road location	Low buildings	Recreation	Off-road trafficability
Unsuited: WET, LPR	Severe: WET, FLD	Severe: WET, FLD	Severe: WET, FLD	Severe: WET.
Poor: WET, LPR	Severe: WET, FLD	Severe: WET, FLD	Severe: WET, FLD	Severe: WET.
Unsuited: WET, LPR	Severe: WET, FLD	Severe: WET, FLD	Severe: WET, FLD	Severe: WET.
Poor: WET, LPR	Severe: WET, FLD	Severe: WET, FLD	Severe: WET, FLD	Severe: WET.
Unsuited: WET, LPR	Severe: WET, FLD	Severe: WET, FLD	Severe: WET, FLD	Severe: WET.
Poor: WET, LPR	Severe: WET, FLD	Severe: WET, FLD	Severe: WET, FLD	Severe: WET.
Poor: WET, LPR	Severe: SLP, WET	Severe: SLP, WET	Severe: SLP, WET	Severe: WET.
Unsuited: WET, LPR	Severe: WET, FLD	Severe: WET, FLD	Severe: WET, FLD	Severe: WET.
Good	Moderate: FLD	Severe: FLD	Moderate: FLD	Slight.
Good to fair: SGR	Moderate: FLD	Severe: FLD	Moderate: FLD	Slight.
Unsuited: LPR, SGR	Moderate: FLD	Severe: FLD	Moderate: FLD	Slight.
Unsuited: LTP	Moderate: FLD	Severe: FLD	Moderate: FLD	Slight.
Good	Moderate: FLD	Severe: FLD	Moderate: FLD	Slight.
Good	Moderate: FLD	Severe: FLD	Moderate: FLD	Slight.
Good to fair: SGR	Moderate: FLD	Severe: FLD	Moderate: FLD	Slight.
Fair: SGR	Severe: SLP, ERO	Severe: SLP	Severe: SLP	Severe: SLP, DSL.
Good	Moderate: FST	Moderate: FST	Slight	Slight.
Good to fair: SGR	Moderate: FST	Moderate: FST	Slight	Slight.
Unsuited: SGR	Moderate: FST	Moderate: FST	Slight	Slight.
Good to fair: SLP, SGR.	Severe: SLP, ERO	Severe: SLP	Severe: SLP	Severe: SLP.
Good to fair: SGR	Slight	Slight	Slight	Slight.
Good to fair: SGR	Slight	Slight	Slight	Slight.
Unsuited	Slight	Slight	Slight	Slight.
Good to fair: SLP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Good to fair: SLP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Good to fair: SLP, SGR.	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Unsuited: LTP	Slight	Slight	Moderate: STN	Slight.
Unsuited: LTP	Severe: SLP	Severe: SLP	Severe: SLP	Moderate to severe: SLP.
Unsuited: LTP	Severe: SLP, BDR	Severe: SLP, BDR	Severe: SLP	Moderate to severe: SLP.
Unsuited: LTP	Severe: PFT	Severe: PFT, SLP	Severe: PFT, SLP	Severe: DSL.
Unsuited: LTP	Severe: PFT, FST	Severe: PFT, FST	Moderate: PFT	Severe: DSL, ERO.
Unsuited: LTP	Moderate: PFT	Moderate: PFT	Slight	Slight.
Unsuited	Severe: SLP	Severe: SLP	Severe: SLP	Moderate to severe: SLP.

TABLE 6.—*Suitability and limitation ratings of*

Map unit component and major land resource area (MLRA) [2]	Suitability ratings [1]		
	Common crops	Rangeland	
		Cattle and sheep	Reindeer
21. Typic Cryopsamments, sandy, nearly level to rolling	Poor: DRT, BLO	Poor: FOR, DRT	Fair to poor: LPR
22. Typic Cryopsamments, sandy, hilly to steep	Unsuited: DRT, SLP.	Poor: FOR, DRT	Fair to poor: LPR
23. Pergelic Cryopsamments, sandy, nearly level to rolling	Unsuited: SFP	Unsuited: LPR, SFP	Good
24. Pergelic Cryopsamments, sandy, hilly to steep	Unsuited: SFP	Unsuited: LPR, SFP	Good
HISTOSOLS			
25. Sphagnic Borofibrists, nearly level to rolling	Unsuited: WET, HUM.	Unsuited: WET, LPR	Poor: LPR
26. Terric Borofibrists, nearly level	Unsuited: WET, HUM	Poor: WET, LPR	Poor: LPR
27. Fluvaquentic Cryofibrists, nearly level	Unsuited: WET, HUM.	Poor: WET, LPR	Poor: LPR
28. Pergelic Cryofibrists, nearly level	Unsuited: WET, LTP.	Unsuited: WET, LPR	Fair: LPR
29. Terric Cryofibrists, nearly level	Unsuited: WET, HUM.	Poor: WET, LPR	Poor: LPR
30. Typic Sphagnofibrists, nearly level to rolling	Unsuited: WET, HUM.	Unsuited: WET, LPR	Poor: LPR
31. Terric Sphagnofibrists, nearly level	Unsuited: WET, HUM.	Unsuited: WET, LPR	Poor: LPR
32. Typic Cryofolists, hilly to steep	Unsuited: SLP, STN.	Unsuited: FOR	Unsuited: LPR
33. Lithic Cryofolists, hilly to steep	Unsuited: SLP, STN.	Unsuited: FOR	Unsuited: LPR
34. Typic Borohemists, nearly level	Unsuited: WET, HUM.	Poor: WET, LPR	Fair: LPR
35. Fluvaquentic Borohemists, nearly level	Unsuited: WET, HUM.	Poor: WET, LPR	Fair: LPR
36. Terric Borohemists, nearly level	Poor: WET, HUM	Poor: WET, LPR	Poor: LPR
37. Typic Cryohemists, nearly level to steep	Unsuited: WET, HUM.	Poor: WET, LPR	Poor: LPR
38. Lithic Cryohemists, hilly to steep	Unsuited: WET, HUM.	Poor: WET, LPR	Poor: LPR
39. Pergelic Cryohemists, nearly level	Unsuited: WET, LTP.	Unsuited: WET, LPR	Fair: LPR
40. Terric Cryohemists, nearly level to steep	Unsuited: WET, HUM.	Poor: WET, LPR	Poor: LPR
41. Terric Borosaprists, nearly level	Poor: WET, HUM	Fair: WET, FOR	Poor: LPR
42. Lithic Cryosaprists, hilly to steep	Unsuited: HUM, BDR.	Unsuited: LPR	Unsuited: LPR
43. Terric Cryosaprists, nearly level to steep	Poor: WET, HUM	Unsuited: LPR	Unsuited: LPR
INCEPTISOLS			
44. Typic Cryandepts, loamy, nearly level to rolling	Fair to poor: LTP	Good to fair: LPR	Good to fair: LTP
45. Typic Cryandepts, loamy, hilly to steep	Poor: LTP, SLP	Good to fair: LPR	Good to fair: LTP
46. Typic Cryandepts, sandy, nearly level to rolling	Poor: LTP	Fair: LPR, SFP	Good
47. Typic Cryandepts, sandy, hilly to steep	Unsuited: LTP, SLP.	Fair: LPR, SFP	Good
48. Typic Cryandepts, very gravelly, nearly level to rolling:			
a. MLRA 171, 178	Poor: LTP	Good to fair: LPR	Good
b. MLRA 175	Poor: LTP	Poor: SFP, LPR	Good

map unit components for selected uses—Continued

Suitability ratings[1]—Continued	Limitation ratings[1]			
Commercial forestry	Road location	Low buildings	Recreation	Off-road trafficability
Poor: SGR, DRT	Moderate: BLO	Slight	Slight	Moderate: LSE.
Poor: SGR, DRT	Severe: SLP, BLO	Severe: SLP	Severe: SLP	Severe: SLP, LSE.
Unsuited: LTP	Moderate: BLO	Moderate: PFT	Moderate: PFT	Moderate: LSE.
Unsuited: LTP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP, LSE.
Unsuited: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.
Unsuited: WET, HUM.	Severe: WET, HUM	Severe: WET, HUM	Very severe: WET, HUM.	Very severe: WET, HUM.
Unsuited: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.
Unsuited: WET, LTP.	Very severe: PFT, HUM.	Very severe: PFT, HUM.	Very severe: PFT. HUM.	Very severe: PFT, HUM.
Unsuited: WET, HUM.	Severe: WET, HUM	Severe: WET, HUM	Very severe: WET, HUM.	Very severe: WET, HUM.
Unsuited: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.
Unsuited: WET, HUM.	Severe: WET, HUM	Severe: WET, HUM	Very severe: WET, HUM.	Very severe: WET, HUM.
Fair: SGR	Moderate: STN, HUM.	Moderate: STN, HUM.	Moderate: STN	Severe: SLP.
Fair: SGR, SLP	Severe: SLP, BDR	Very severe: SLP, BDR.	Very severe: SLP, STN.	Very severe: SLP.
Unsuited: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.
Unsuited: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.
Unsuited: WET, HUM.	Severe: WET, HUM	Severe: WET, HUM	Very severe: WET, HUM.	Very severe: WET, HUM.
Unsuited: WET, SGR.	Very severe: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.	Very severe: WET, HUM.
Unsuited: WET, LTP.	Very severe: SLP, BDR.	Very severe: SLP, BDR.	Very severe: SLP, BDR.	Very severe: SLP.
Unsuited: WET, LTP.	Very severe: PFT, HUM.	Very severe: PFT, HUM.	Very severe: PFT, HUM.	Very severe: PFT, HUM.
Unsuited: WET, HUM.	Severe: WET, HUM	Severe: WET, HUM	Very severe: WET, HUM.	Very severe: WET, HUM.
Unsuited: WET	Severe: WET, HUM	Severe: WET, HUM	Very severe: WET, HUM.	Very severe: WET, HUM.
Unsuited: WET, SGR.	Very severe: SLP, BDR.	Very severe: SLP, BDR.	Very severe: SLP, BDR.	Very severe: SLP.
Fair: WET, SGR	Severe: WET, HUM	Severe: WET, HUM	Very severe: WET, HUM.	Very severe: WET, HUM.
Unsuited: LTP	Moderate: LSC	Moderate: LSC	Slight	Moderate: DSL.
Unsuited: LTP	Severe: SLP, LSC	Severe: SLP, LSC	Severe: SLP	Severe: SLP, DSL.
Unsuited: LTP	Slight	Slight	Slight	Slight.
Unsuited: LTP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP, LSE.
Unsuited: LTP	Slight	Slight	Slight	Slight.
Unsuited: LTP	Slight	Slight	Slight	Slight.

TABLE 6.—*Suitability and limitation ratings of*

Map unit component and major land resource area (MLRA) [2]	Suitability ratings [1]		
	Common crops	Rangeland	
		Cattle and sheep	Reindeer
49. Typic Cryandepts, very gravelly, hilly to steep:			
a. MLRA 170, 171	Unsuited: LTP, STN.	Good to fair: LPR	Good
b. MLRA 173, 175, 178, 179	Unsuited: LTP, STN.	Poor: SFP, LPR	Good
50. Dystric Cryandepts, loamy, nearly level to rolling:			
a. MLRA 170, 171	Poor: LTP	Good to fair: LPR	Good
b. MLRA 175	Fair: LTP	Poor: LPR, SFP	Good
51. Dystric Cryandepts, loamy, hilly to steep:			
a. MLRA 170	Poor: SLP, LTP	Fair: LPR, SFP	Fair: LPR
b. MLRA 171	Poor: SLP, LTP	Good to fair: LPR	Good
c. MLRA 175	Poor: SLP, LTP	Poor: SFP, LPR	Good
52. Dystric Lithic Cryandepts, loamy, hilly to steep	Unsuited: BDR, LTP.	Poor: LPR	Good
53. Dystric Lithic Cryandepts, very gravelly, hilly to steep	Unsuited: BDR, STN.	Poor: LPR	Good
54. Lithic Cryandepts, very gravelly, hilly to steep	Unsuited: BDR, STN.	Poor: LPR	Good
55. Typic Cryaquepts, loamy, nearly level to rolling:			
a. MLRA 170	Fair to poor: WET	Poor: FOR, WET	Poor: LPR
b. MLRA 171	Unsuited: WET, LTP.	Good to fair: LPR	Fair: LPR
56. Typic Cryaquepts, very gravelly, nearly level to rolling	Poor: WET, STN	Poor: FOR, WET	Poor: LPR
57. Typic Cryaquepts, very gravelly, hilly to steep	Unsuited: WET, SLP.	Unsuited: FOR	Unsuited: LPR
58. Aeric Cryaquepts, loamy, nearly level to rolling	Good: PIT	Poor: FOR, SFP	Fair to poor: LPR
59. Aeric Cryaquepts, very gravelly, nearly level to rolling	Good	Poor: FOR, SFP	Fair to poor: LPR
60. Aeric Humic Cryaquepts, loamy, nearly level to rolling	Fair: WET	Good	Poor: LPR
61. Andic Cryaquepts, loamy, nearly level to rolling	Poor: WET, LTP	Good to fair: LPR	Fair: LPR
62. Histic Cryaquepts, loamy, nearly level to rolling	Poor: WET	Poor: LPR, WET	Poor: LPR
63. Histic Cryaquepts, very gravelly, nearly level to rolling	Unsuited: WET, STN.	Poor: LPR, WET	Poor: LPR
64. Histic Pergelic Cryaquepts, clayey, nearly level to rolling	Unsuited: LTP, WET.	Unsuited: LPR, SFP	Good
65. Histic Pergelic Cryaquepts, loamy, nearly level to rolling:			
a. MLRA 169, 170, 172, 173, 174, 175, 176	Poor: WET, LTP	Poor to unsuited: LPR, SFP.	Good
b. MLRA 177, 178, 179, 180, 181, 182	Unsuited: LTP, WET.	Unsuited: LPR, SFP	Good
66. Histic Pergelic Cryaquepts, loamy, hilly to steep	Unsuited: SLP, WET.	Unsuited: LPR, SFP	Good
67. Histic Pergelic Cryaquepts, sandy, nearly level to rolling	Unsuited: WET, LTP.	Poor: LPR, SFP	Good
68. Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling	Unsuited: WET, STN.	Unsuited: LPR, SFP	Good

map unit components for selected uses—Continued

Suitability ratings [1]—Continued	Limitation ratings [1]			
Commercial forestry	Road location	Low buildings	Recreation	Off-road trafficability
Unsuited: LTP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Unsuited: LTP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Unsuited: LTP	Moderate: LSC	Moderate: LSC	Slight	Moderate: DSL.
Unsuited: LTP	Moderate: LSC	Moderate: LSC	Slight	Moderate: DSL.
Unsuited: LTP	Severe: SLP, LSC	Severe: SLP, LSC	Severe: SLP	Severe: SLP, DSL.
Unsuited: LTP	Severe: SLP, LSC	Severe: SLP, LSC	Severe: SLP	Severe: SLP, DSL.
Unsuited: LTP	Severe: SLP, LSC	Severe: SLP, LSC	Severe: SLP	Severe: SLP, DSL.
Unsuited: LTP	Very severe: SLP, BDR.	Very severe: SLP, BDR.	Very severe: SLP, BDR.	Very severe: SLP.
Unsuited: LTP	Very severe: SLP, BDR.	Very severe: SLP, BDR.	Very severe: SLP, BDR.	Very severe: SLP.
Unsuited: LTP	Very severe: SLP, BDR.	Very severe: SLP, BDR.	Very severe: SLP, BDR.	Very severe: SLP.
Poor: WET	Severe: WET	Severe: WET	Severe: WET	Severe: WET.
Unsuited: LTP	Severe: WET	Severe: WET	Severe: WET	Severe: WET.
Poor: WET	Severe: WET	Severe: WET	Severe: WET	Severe: WET.
Fair: FOR, WET	Severe: WET, SLP	Severe: WET, SLP	Severe: WET, SLP	Severe: WET, SLP.
Good to fair: SGR	Moderate: FST, LSC	Moderate to severe: PIT, FST.	Slight	Moderate: DSL.
Good	Slight	Slight	Slight	Moderate: DSL.
Poor: WET	Severe: WET, FST	Severe: WET, FST	Severe: WET	Severe: WET, DSL.
Unsuited: LTP	Severe: WET	Severe: WET	Severe: WET	Severe: WET.
Poor: SGR, WET	Severe: WET, FST	Severe: WET	Severe: WET	Severe: WET.
Unsuited: WET	Severe: WET, FST	Severe: WET	Very severe: WET, STN.	Severe: WET.
Unsuited: LTP	Very severe: WET, PFT.	Very severe: WET, PFT.	Severe: WET	Severe: WET.
Unsuited: LTP	Very severe: WET, PFT.	Very severe: WET, PFT.	Severe: WET	Severe: WET.
Unsuited: LTP	Very severe: WET, PFT.	Very severe: WET, PFT.	Severe: WET	Severe: WET.
Unsuited: LTP	Very severe: WET, PFT.	Very severe: WET, PFT.	Very severe: SLP, WET.	Very severe: WET, SLP.
Unsuited: LTP	Severe: WET, PFT	Severe: WET, PFT	Severe: WET	Severe: WET.
Unsuited: LTP	Severe: WET, PFT	Severe: WET, PFT	Severe: WET	Severe: WET.

TABLE 6.—*Suitability and limitation ratings of*

Map unit component and major land resource area (MLRA) [2]	Suitability ratings [1]		
	Common crops	Rangeland	
		Cattle and sheep	Reindeer
69. Histic Pergelic Cryaquepts, very gravelly, hilly to steep	Unsuited: WET, STN.	Unsuited: LPR, SFP	Good
70. Humic Cryaquepts, loamy, nearly level to rolling	Poor: WET	Poor: FOR, WET	Poor: LPR
71. Lithic Cryaquepts, very gravelly, hilly to steep	Unsuited: WET, BDR.	Unsuited: LPR, SFP	Good
72. Pergelic Cryaquepts, loamy, nearly level to rolling:			
a. MLRA 174, 175, 176	Fair to poor: WET	Poor: LPR, SFP	Good
b. MLRA 172, 173, 177, 178, 179, 180, 181, 182	Unsuited: LTP, WET.	Unsuited: LPR, SFP	Good
73. Pergelic Cryaquepts, loamy, hilly to steep	Unsuited: SLP, WET.	Unsuited: LPR, SFP	Good
74. Pergelic Cryaquepts, sandy, nearly level to rolling	Unsuited: LTP, WET.	Unsuited: LPR, SFP	Good
75. Pergelic Cryaquepts, very gravelly, nearly level to rolling	Unsuited: LTP, WET.	Unsuited: LPR, SFP	Good
76. Pergelic Cryaquepts, very gravelly, hilly to steep	Unsuited: LTP, WET.	Unsuited: LPR, SFP	Good
77. Pergelic Ruptic-Histic Cryaquepts, clayey, nearly level to rolling	Unsuited: LTP, WET.	Unsuited: LPR, SFP	Good
78. Pergelic Ruptic-Histic Cryaquepts, loamy, nearly level to rolling	Unsuited: LTP, WET.	Unsuited: LPR, SFP	Good
79. Pergelic Ruptic-Histic Cryaquepts, very gravelly, nearly level to rolling	Unsuited: LTP, WET.	Unsuited: LPR, SFP	Good
80. Pergelic Ruptic-Histic Cryaquepts, very gravelly, hilly to steep	Unsuited: LTP, WET.	Unsuited: LPR, SFP	Good
81. Typic Cryochrepts, loamy, nearly level to rolling:			
a. MLRA 169, 172, 173	Fair: SFP	Poor: FOR	Fair to poor: LPR
b. MLRA 174, 175, 176	Good	Poor: FOR	Fair to poor: LPR
82. Typic Cryochrepts, loamy, hilly to steep	Poor: SLP, ERO	Poor: FOR	Fair to poor: LPR
83. Typic Cryochrepts, sandy, nearly level to rolling	Fair: DRT, BLO	Poor: FOR	Fair to poor: LPR
84. Typic Cryochrepts, sandy, hilly to steep	Poor: SLP, BLO	Poor: FOR	Fair to poor: LPR
85. Typic Cryochrepts, very gravelly, nearly level to rolling:			
a. MLRA 169, 172, 173	Fair to poor: SFP, DRT.	Poor: FOR	Fair to poor: LPR
b. MLRA 174, 176	Fair: DRT	Poor: FOR	Fair to poor: LPR
86. Typic Cryochrepts, very gravelly, hilly to steep	Poor: SLP, DRT	Poor: FOR	Fair to poor: LPR
87. Alfic Cryochrepts, loamy, nearly level to rolling	Good	Poor: FOR	Fair to poor: LPR
88. Alfic Cryochrepts, loamy, hilly to steep	Poor: SLP, ERO	Poor: FOR	Fair to poor: LPR
89. Alfic Cryochrepts, very gravelly, hilly to steep	Poor: SLP, DRT	Poor: FOR	Fair to poor: LPR
90. Andic Cryochrepts, very gravelly, hilly to steep	Poor: SLP, DRT	Poor: FOR	Fair to poor: LPR
91. Dystric Cryochrepts, very gravelly, hilly to steep	Poor: SLP, DRT	Poor: FOR	Fair to poor: LPR

map unit components for selected uses—Continued

Suitability ratings [1]—Continued	Limitation ratings [1]			
Commercial forestry	Road location	Low buildings	Recreation	Off-road trafficability
Unsuited: LTP	Severe: WET, SLP	Severe: WET, SLP	Severe: WET, SLP	Severe: WET, SLP.
Poor: SGR, WET	Severe: WET, FST	Severe: WET	Severe: WET	Severe: WET.
Unsuited: LTP	Severe: SLP, BDR	Severe: SLP, BDR	Severe: SLP, BDR	Severe: SLP.
Poor: LTP	Severe: WET, PFT	Severe: WET, PFT	Severe: WET	Severe: WET.
Unsuited: LTP	Severe: WET, PFT	Severe: WET, PFT	Severe: WET	Severe: WET.
Unsuited: LTP	Very severe: WET, SLP.	Very severe: WET, SLP.	Very severe: WET, SLP.	Very severe: WET, SLP.
Unsuited: LTP	Severe: WET, PFT	Severe: WET, PFT	Severe: WET	Severe: WET.
Unsuited: LTP	Severe: WET, PFT	Severe: WET, PFT	Severe: WET	Severe: WET.
Unsuited: LTP	Severe: SLP, WET	Severe: SLP, WET	Severe: SLP, WET	Severe: SLP, WET.
Unsuited: LTP	Very severe: WET, PFT.	Very severe: WET, PFT.	Severe: WET	Very severe: WET.
Unsuited: LTP	Very severe: WET, PFT.	Very severe: WET, PFT.	Severe: WET	Very severe: WET.
Unsuited: LTP	Severe: WET, PFT	Severe: WET, PFT	Severe: WET	Severe: WET.
Unsuited: LTP	Severe: SLP, WET	Severe: SLP, WET	Severe: SLP, WET	Severe: SLP, WET.
Fair: SGR	Moderate: FST, LSC	Moderate: FST, LSC	Slight	Slight.
Good	Moderate: FST, LSC	Moderate: FST, LSC	Slight	Slight.
Good	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Fair: SGR	Slight	Slight	Slight	Slight.
Fair: SGR, SLP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Fair: SGR	Slight	Slight	Slight	Slight.
Good	Slight	Slight	Slight	Slight.
Fair to poor: SGR, SLP.	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Good	Moderate: FST	Moderate: LSC, FST	Slight	Slight.
Good to fair: SLP	Severe: SLP	Severe: SLP	Severe: SLP	Moderate to severe: SLP.
Fair: SGR, SLP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Fair: SGR, SLP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Fair: SGR, SLP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.

TABLE 6.—*Suitability and limitation ratings of*

Map unit component and major land resource area (MLRA) [2]	Suitability ratings [1]		
	Common crops	Rangeland	
		Cattle and sheep	Reindeer
92. Lithic Cryochrepts, very gravelly, hilly to steep:			
a. MLRA 169, 172, 173, 174, 175, 176, 177	Unsuited: BDR, SFP.	Poor: LPR	Good to fair: LPR
b. MLRA 180, 181	Unsuited: BDR, SFP.	Unsuited: LPR, SFP	Good
93. Pergelic Cryochrepts, very gravelly, hilly to steep	Unsuited: SFP	Unsuited: LPR, SFP	Good
94. Typic Cryumbrepts, very gravelly, hilly to steep	Poor: SLP, STN	Poor: LPR, SFP	Good to fair: LPR
95. Entic Cryumbrepts, loamy, nearly level to rolling	Fair: SFP	Poor: LPR, SFP	Good to fair: LPR
96. Entic Cryumbrepts, very gravelly, hilly to steep	Poor: SLP, STN	Poor: LPR, SFP	Good to fair: LPR
97. Lithic Cryumbrepts, very gravelly, hilly to steep	Unsuited: SLP, BDR.	Unsuited: LPR, SFP	Good to fair: LPR
98. Lithic Ruptic-Entic Cryumbrepts, very gravelly, hilly to steep	Unsuited: SLP, BDR.	Unsuited: LPR, SFP	Good to fair: SGR
99. Pergelic Cryumbrepts, very gravelly, nearly level to rolling	Unsuited: SFP	Unsuited: LPR, SFP	Good
100. Pergelic Cryumbrepts, very gravelly, hilly to steep	Unsuited: SFP	Unsuited: LPR, SFP	Good
MOLLISOLS			
101. Pergelic Cryaquolls, loamy, nearly level to rolling	Unsuited: LTP, WET.	Unsuited: LPR, SFP	Good
102. Pergelic Cryaquolls, very gravelly, nearly level to rolling	Unsuited: LTP, WET.	Unsuited: LPR, SFP	Good
103. Pergelic Cryaquolls, very gravelly, hilly to steep	Unsuited: LTP, WET.	Unsuited: LPR, SFP	Good
104. Typic Cryoborolls, loamy, nearly level to rolling	Fair: SFP	Poor: SFP, FOR	Fair: LPR
105. Lithic Ruptic-Entic Cryoborolls, very gravelly, hilly to steep	Unsuited: SFP	Unsuited: LPR, SFP	Good to fair: SGR
106. Pergelic Cryoborolls, very gravelly, nearly level to rolling	Unsuited: SFP	Unsuited: LPR, SFP	Good
107. Pergelic Cryoborolls, very gravelly, hilly to steep	Unsuited: SFP	Unsuited: LPR, SFP	Good
SPODOSOLS			
108. Typic Cryaquods, sandy, nearly level	Poor: WET	Poor: LPR, SFP	Poor: LPR
109. Lithic Cryaquods, very gravelly, hilly to steep	Unsuited: SLP, BDR.	Unsuited: LPR, SFP	Unsuited: LPR
110. Pergelic Sideric Cryaquods, loamy, nearly level to rolling	Poor: WET, LTP	Unsuited: LPR, SFP	Fair: LPR
111. Sideric Cryaquods, loamy, nearly level to rolling	Fair: WET	Poor: FOR	Poor: LPR
112. Sideric Cryaquods, sandy, nearly level to rolling	Poor: WET	Poor: FOR	Poor: LPR
113. Sideric Cryaquods, very gravelly, nearly level to rolling	Poor: WET, STN	Poor: FOR	Poor: LPR
114. Cryic Fragiaquods, very gravelly, nearly level to steep	Poor: WET, SLP	Unsuited: FOR	Unsuited: LPR
115. Placic Haplaquods, loamy, nearly level to rolling	Poor: WET	Unsuited: FOR	Unsuited: LPR
116. Typic Cryohumods, loamy, hilly to steep	Poor: SLP	Unsuited: FOR	Unsuited: LPR

map unit components for selected uses—Continued

Suitability ratings [1]—Continued	Limitation ratings [1]			
Commercial forestry	Road location	Low buildings	Recreation	Off-road trafficability
Poor: SGR	Severe: SLP, BDR	Severe: SLP, BDR	Severe: SLP	Severe: SLP.
Unsuited: LTP	Severe: SLP, BDR	Severe: SLP, BDR	Severe: SLP	Severe: SLP.
Unsuited: LTP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Unsuited: LTP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Fair to poor: SGR	Moderate: FST	Moderate: FST, LSC	Slight	Slight.
Unsuited: LTP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Unsuited: LTP	Severe: SLP, BDR	Severe: SLP, BDR	Severe: SLP	Severe: SLP.
Unsuited: LTP	Severe: SLP, BDR	Severe: SLP, BDR	Severe: SLP	Severe: SLP.
Unsuited: LTP	Moderate: PFT	Moderate: PFT	Slight	Slight.
Unsuited: LTP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Unsuited: LTP	Severe: PFT, WET	Severe: PFT, WET	Severe: WET	Severe: WET.
Unsuited: LTP	Severe: PFT, WET	Severe: PFT, WET	Severe: WET	Severe: WET.
Unsuited: LTP	Severe: SLP, WET	Severe: SLP, WET	Severe: SLP, WET	Severe: SLP, WET.
Fair to poor: SGR	Moderate: FST	Moderate: FST, LSC	Slight	Slight.
Unsuited: LTP	Severe: SLP, BDR	Severe: SLP, BDR	Severe: SLP	Severe: SLP.
Unsuited: LTP	Moderate: PFT	Moderate: PFT	Slight	Slight.
Unsuited: LTP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Unsuited: WET, SGR	Severe: WET	Severe: WET	Severe: WET	Severe: WET.
Poor: WET, SGR	Severe: SLP, BDR	Severe: SLP, BDR	Severe: SLP, WET	Severe: SLP.
Unsuited: LTP, WET	Severe: WET, PFT	Severe: WET, PFT	Severe: WET	Severe: WET.
Fair: SGR	Moderate: FST	Moderate: FST	Slight	Slight.
Fair: SGR	Slight	Slight	Slight	Slight.
Fair: SGR	Slight	Slight	Slight	Slight.
Fair: WET	Severe: SLP, WET	Severe: SLP, WET	Severe: SLP, WET	Severe: SLP, WET.
Poor: WET	Moderate: WET	Severe: WET	Severe: WET	Severe: WET.
Good	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.

TABLE 6.—*Suitability and limitation ratings of*

Map unit component and major land resource area (MLRA) [2]	Suitability ratings [1]		
	Common crops	Rangeland	
		Cattle and sheep	Reindeer
117. Lithic Cryohumods, loamy, hilly to steep	Unsuited: SLP, BDR.	Unsuited: FOR	Unsuited: LPR
118. Lithic Cryohumods, very gravelly, hilly to steep	Unsuited: SLP, BDR.	Poor: LPR, SFP	Good to fair: LPR
119. Cryic Placohumods, loamy, hilly to steep	Poor: LTP, SLP	Unsuited: FOR	Unsuited: LPR
120. Typic Cryorthods, loamy, nearly level to rolling	Good	Fair: FOR	Poor: LPR
121. Typic Cryorthods, loamy, hilly to steep	Poor: SLP, ERO	Fair: FOR	Poor: LPR
122. Typic Cryorthods, sandy, nearly level to rolling	Fair: DRT	Poor: FOR, SFP	Poor: LPR
123. Typic Cryorthods, sandy, hilly to steep:			
a. MLRA 168, 169	Poor: SLP, DRT	Poor: FOR	Unsuited: LPR
b. MLRA 174, 175	Poor: SLP, DRT	Poor: FOR	Fair to poor: LPR
124. Typic Cryorthods, very gravelly, nearly level to rolling:			
a. MLRA 170, 174, 175, 177	Good to fair: DRT	Poor: FOR	Fair to poor: LPR
b. MLRA 169, 173	Poor: SFP	Poor: FOR	Fair: LPR
125. Typic Cryorthods, very gravelly, hilly to steep:			
a. MLRA 168	Poor: SLP, STN	Unsuited: FOR	Unsuited: LPR
b. MLRA 170	Poor: SLP, STN	Poor: FOR	Poor: LPR
c. MLRA 169, 172, 173	Unsuited: SFP	Unsuited: FOR, SFP	Fair: LPR
d. MLRA 174, 175, 177	Poor: SLP	Poor: FOR, SFP	Fair to poor: LPR
126. Entic Cryorthods, sandy, nearly level to rolling	Poor: DRT	Poor: FOR, DRT	Fair to poor: LPR
127. Entic Cryorthods, sandy, hilly to steep	Poor: SLP, DRT	Poor: FOR, DRT	Fair to poor: LPR
128. Humic Cryorthods, loamy, nearly level to rolling	Fair to poor: LTP	Poor: FOR, SFP	Fair: LPR
129. Humic Cryorthods, loamy, hilly to steep	Poor: SLP, LTP	Good to fair: SFP	Poor: LPR
130. Humic Cryorthods, very gravelly, nearly level to rolling	Poor: STN	Poor: FOR	Unsuited: LPR
131. Humic Cryorthods, very gravelly, hilly to steep:			
a. MLRA 168, 169	Poor: SLP	Poor: FOR	Unsuited: LPR
b. MLRA 170, 172	Poor: SLP	Good to fair: SFP	Poor: LPR
c. MLRA 171	Unsuited: LTP, SLP.	Good	Fair to poor: LPR
d. MLRA 175, 178	Unsuited: LTP, SLP.	Good to fair: SFP	Fair: LPR
132. Humic Lithic Cryorthods, very gravelly, hilly to steep	Unsuited: SLP, BDR.	Unsuited: FOR	Unsuited: LPR
133. Lithic Cryorthods, loamy, hilly to steep	Unsuited: SLP, BDR.	Fair: SFP, LPR	Poor: LPR
134. Lithic Cryorthods, very gravelly, hilly to steep	Unsuited: LTP, SLP.	Unsuited: LTP, SLP	Good to fair: LPR
135. Pergelic Cryorthods, sandy, nearly level to rolling	Unsuited: SFP	Unsuited: LPR, SFP	Good
136. Pergelic Cryorthods, very gravelly, nearly level to rolling	Unsuited: SFP	Unsuited: SFP, LPR	Good
137. Pergelic Cryorthods, very gravelly, hilly to steep	Unsuited: SFP	Unsuited: SFP, LPR	Good
138. Cryic Fragiorthods, very gravelly, nearly level to rolling	Poor: STN	Unsuited: FOR	Unsuited: LPR
139. Cryic Fragiorthods, very gravelly, hilly to steep	Unsuited: SLP, STN.	Unsuited: FOR	Unsuited: LPR

map unit components for selected uses—Continued

Suitability ratings [1]—Continued	Limitation ratings [1]			
Commercial forestry	Road location	Low buildings	Recreation	Off-road trafficability
Good	Severe: SLP, BDR	Severe: SLP	Severe: SLP	Severe: SLP.
Poor: SGR	Severe: SLP, BDR	Severe: SLP	Severe: SLP	Severe: SLP.
Good	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Good	Moderate: FST, LSC	Moderate: FST, LSC	Slight	Slight.
Good	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Fair: SGR	Slight	Slight	Slight	Slight.
Good to fair: SGR	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP, LSE.
Poor: SGR	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Good	Slight	Slight	Slight	Slight.
Fair: SGR	Slight	Slight	Slight	Slight.
Good	Severe: SLP, STN	Severe: SLP	Severe: SLP	Severe: SLP.
Good	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Poor: SGR	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Good to fair: SGR	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Fair to poor: SGR	Slight	Slight	Slight	Slight.
Poor: SGR	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Fair to poor: SGR	Moderate: FST, LSC	Moderate: FST, LSC	Slight	Slight: DSL.
Poor: SGR	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Good	Slight	Slight	Slight	Slight.
Good	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Poor: SGR	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Unsuited: LTP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Unsuited: LTP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Fair: SLP	Very severe: SLP, BDR.	Very severe: SLP, BDR.	Very severe: SLP	Very severe: SLP.
Unsuited: SGR, LPR	Severe: SLP, BDR	Severe: SLP, BDR	Severe: SLP	Severe: SLP.
Unsuited: LTP	Very severe: SLP	Very severe: SLP	Very severe: SLP	Very severe: SLP.
Unsuited: LTP	Moderate: BLO	Moderate: PFT	Moderate: PFT	Moderate: LSE.
Unsuited: LTP	Moderate: PFT	Moderate: PFT	Moderate: STN	Slight.
Unsuited: LTP	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.
Good	Slight	Slight	Slight	Slight.
Good	Severe: SLP	Severe: SLP	Severe: SLP	Severe: SLP.

TABLE 6.—*Suitability and limitation ratings of*

Map unit component and major land resource area (MLRA) [2]	Suitability ratings [1]		
	Common crops	Rangeland	
		Cattle and sheep	Reindeer
MISCELLANEOUS AREAS			
140. Cinder land	Unsuited: STN	Unsuited: LPR, DRT	Unsuited: SGR
141. Dune land	Unsuited: DRT, BLO.	Unsuited: DRT, LPR	Unsuited: SGR
142. Gravelly beaches	Unsuited: STN	Unsuited: LPR	Unsuited: LPR
143. Lava flows	Unsuited: BDR	Unsuited: LPR	Unsuited: LPR
144. Riverwash	Unsuited: STN, WET.	Unsuited: LPR	Unsuited: LPR
145. Rough mountainous land	Unsuited: SLP, BDR.	Unsuited: SFP, LPR	Poor to unsuited: SGR.
146. Rubble land	Unsuited: SLP, STN.	Unsuited: LPR	Unsuited: LPR
147. Tidal flats	Unsuited: WET	Unsuited: WET, LPR	Unsuited: WET, LPR

[1] *Explanation of Symbols*

BDR—Shallow bedrock.
BLO—Soil is susceptible to blowing.
CXP—Complex soil pattern caused by stream scars.
DRT—Droughty; soil has low water-supplying capacity.
DSL—Soil is dusty when dry and soft or slippery when wet.
ERO—Soil is highly susceptible to erosion.
FLD—Soil is susceptible to flooding.
FOR—Vegetation is dominantly forest or tall brush.
FST—Soil is susceptible to frost action.
HUM—Organic soil; peat.
LSC—Soil has low load-supporting capacity.
LSE—Loose, unstable sand.
LPR—Low proportion of desirable species.
LTP—Low soil temperatures throughout growing season.
PFT—Soil has perennially frozen substratum.
PIT—Soil is susceptible to thermokarst pitting.
SFP—Short frost-free period.
SGR—Slow growth rate of desirable plant species.
SLP—Steep slopes or rough terrain.
STN—Stones or boulders interfere with intended use.
WET—Soils are wet; high water table or seepage during most or all of the frost-free season.

can be grown under ordinary management practices. On soils of this group—

(1) Loamy texture extends to a depth of at least 18 inches (45 cm).
(2) Crop growth is not impeded by excessive soil moisture during the growing season.
(3) Damage by flooding occurs no more frequently than 1 year in 10.
(4) Slopes are dominantly less than 7 percent.
(5) Periods of soil moisture deficiency are rare, or irrigation is economically feasible.
(6) Damage to crops as a result of early frost can be expected no more frequently than 2 years in 10.
(7) The hazard of wind erosion is estimated to be slight.

Fair. Soil or climate limitations need to be recognized but can be overcome. Common crops can be grown, but careful management and special practices may be required. On soils of this group—

(1) Loamy texture extends to a depth of at least 10 inches (25 cm).
(2) Periods of excessive soil moisture, which can impede crop growth during the growing season, do not exceed a total of 2 weeks.
(3) Damage by flooding occurs no more frequently than 2 years in 10.
(4) Slopes are dominantly less than 12 percent.
(5) Periods of soil moisture deficiency are infrequent.
(6) Damage to crops as a result of early frost can be expected no more frequently than 3 years in 10.
(7) There is no more than a moderate hazard of wind erosion.

Poor. Soil or climate limitations are difficult to overcome and are severe enough to make the use questionable. The choice of crops is narrow, and special treatment or management practices are required. In some places, overcoming the limitations may not be feasible. On soils of this group—

(1) Loamy texture extends to a depth of at least 5 inches (12 cm).
(2) Periods of excessive soil moisture during the growing season do not exceed a total of 3 weeks.
(3) Damage by flooding occurs no more frequently than 3 years in 10.
(4) Slopes are dominantly less than 20 percent.
(5) Periods of soil moisture deficiency are not frequent enough to severely damage crops.
(6) Climatic conditions permit at least one of the common crops—usually grasses—to be grown successfully in most years.

map unit components for selected uses—Continued

Suitability ratings [1]—Continued	Limitation ratings [1]			
Commercial forestry	Road location	Low buildings	Recreation	Off-road trafficability
Unsuited: DRT	Moderate to severe: SLP, STN.	Moderate to severe: SLP, STN.	Severe: SLP, STN	Moderate to severe: SLP.
Unsuited: DRT	Severe: SLP, BLO	Severe: SLP	Very severe: SLP, BLO.	Very severe: LSE.
Unsuited: LPR	Very severe: LSC, CXP.	Very severe: LSC	Very severe: STN	Moderate: CXP.
Unsuited: BDR, DRT	Very severe: BDR	Very severe: BDR	Very severe: BDR	Very severe: SLP.
Unsuited: WET	Very severe: FLD	Very severe: FLD	Very severe: FLD	Very severe: CXP.
Unsuited: LTP	Very severe: SLP	Very severe: SLP	Very severe: SLP	Very severe: SLP.
Unsuited: DRT	Very severe: SLP	Very severe: SLP	Very severe: SLP, STN.	Very severe: SLP.
Unsuited: WET	Very severe: WET, FLD.	Very severe: WET, FLD.	Very severe: WET	Very severe: WET.

[1] *Major Land Resource Areas:*

Southern Alaska
168 Southeastern Alaska
169 South Central Alaska Mountains
170 Cook Inlet-Susitna Lowland
171 Alaska Peninsula and Southwestern Islands

Interior Alaska
172 Copper River Plateau
173 Alaska Range
174 Interior Alaska Lowlands
175 Kuskokwim Highlands
176 Interior Alaska Highlands

Arctic and Western Alaska
177 Norton Sound Highlands
178 Western Alaska Coastal Plains and Deltas
179 Bering Sea Islands
180 Brooks Range
181 Arctic Foothills
182 Arctic Coastal Plain

Unsuited. Soil or climate limitations are generally too severe to be overcome. None of the common crops can be grown successfully in most years, or there is danger of excessive damage to soils by erosion if cultivation is attempted.

Range for cattle and sheep

As in the case of potential cropland, only a very small proportion of the total area of rangeland in Alaska is utilized for grazing. The most favorable grassland in the State occurs along the Pacific Coast of the Alaska Peninsula, on the Kodiak Island group and the southern part of the Kenai Peninsula, and on the Shumagin and Aleutian Islands. Grassland also occurs close to tree line in areas fringing the Cook Inlet-Susitna Lowland at elevations of about 1,000 to 1,500 feet (300 to 450 m) and in regions bordering the north coasts of the Gulf of Alaska and Bristol Bay. In interior Alaska grasses are common in areas of recent forest fires and in small scattered grassy meadows on the flood plains. Grasses are also fairly common in the understory of forests in many parts of central and southern Alaska, but the stands are generally sparse.

The grazing season in interior Alaska and in the northern coastal regions is comparatively short, generally 3 to 4 months, and winter feeding is required. On Kodiak Island and the Aleutians, cattle or sheep can graze year round, but in most areas some winter feeding is desirable.

Ratings of soils are based on characteristics of both soils and the natural vegetation. In many areas, grazing land could be created by clearing the natural forest, but this is not considered in the ratings. Soils covered by tundra vegetation or forests with little or no grass in the understory are considered unsuitable. Soils which support only a sparse or slow-growing grassy vegetation or which are in areas with very short growing seasons have only limited usefulness for grazing. The most important adverse soil characteristics are poor drainage and wet conditions during much or all of the grazing season. A few sandy soils have slow growth rates because of droughtiness. The soils were rated on the following basis:

Good. The natural vegetation is dominantly grasses and palatable forbs. Cattle or sheep can graze most of the year.

Fair. The natural vegetation includes grasses and palatable forbs, but it provides grazing for only relatively short periods or the vegetation is dominated by nonpalatable species. Soils that support palatable species but that are excessively wet during part of the growing season are included in this rating.

Poor. Some of the natural vegetation is suitable for grazing, but quality is poor or production is low.

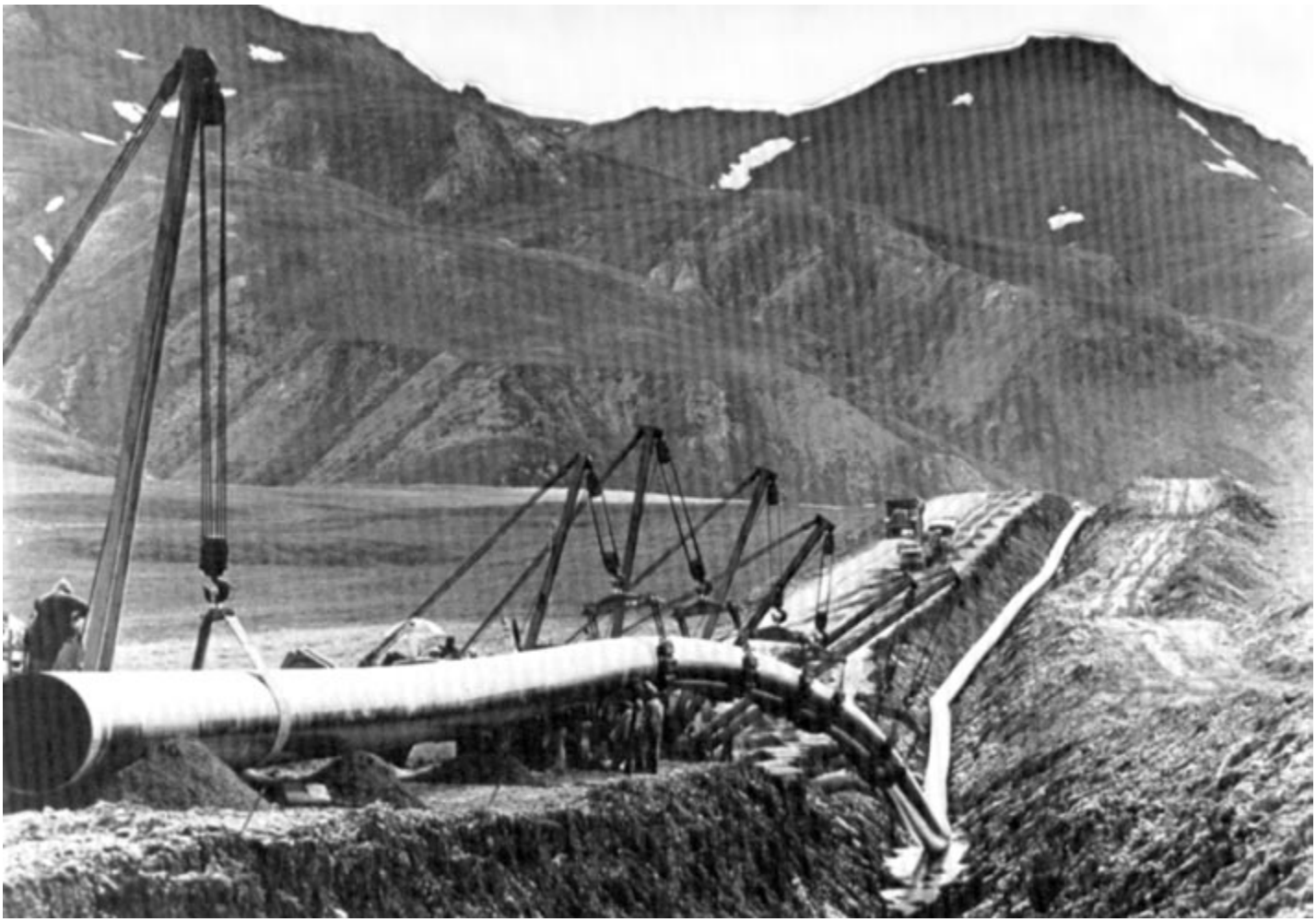

Figure 48.—Section of trans-Alaska pipeline is lowered into a ditch in the Brooks Range. About 175 miles south of Prudhoe Bay.

These soils would not normally be used as cattle or sheep range.

Unsuitable. Soil or vegetation conditions are such that the soil cannot be used as cattle or sheep range.

Range for reindeer

Commercial reindeer herds are kept only in areas bordering the Bering and Chukchi Seas. Caribou, of the same species as reindeer but managed only as wildlife, range over many areas in interior and arctic Alaska. Feral reindeer, formerly domesticated reindeer that are now wild, are on Kodiak Island, some of the Aleutian Islands, and St. Matthew Island in the Bering Sea. Both reindeer and caribou have the same feeding requirements. All soils are evaluated in terms of suitability for reindeer range, but these ratings should not be construed as a recommendation that commercial reindeer herds replace caribou in any part of Alaska where such herds are not permitted by law.

Reindeer subsist on a wide variety of plants, including sedges, grasses, forbs, mushrooms, and low tundra shrubs, especially willows. In winter they have the ability to survive on lichens and plants that are preserved under the snow in green condition. They are primarily tundra (including alpine tundra) animals, but in winter they commonly migrate to the forested or shrub-covered regions adjacent to the tundra. Because plants in tundra or tundra-fringe areas are slow-growing, reindeer herds require large grazing areas. It is likely that between 200 and 300 acres (80 to 120 hectares) must be available per animal for sustained use over long periods.

Very large sections of Alaska are suitable for reindeer grazing. The principal limiting factors are a low proportion of suitable plants, as in forests dominated by coniferous trees and some sparsely vegetated alpine tundras, and very slow growth rates on droughty or excessively steep soils. Soils were rated for reindeer range on the following basis:

Good. The natural vegetation includes a high proportion of plants suitable for either summer or winter grazing by reindeer.

Fair. The natural vegetation includes plants suitable for use by reindeer, but the total availability of

such plants is significantly less than that of typical arctic tundra.

Poor. The natural vegetation includes a low proportion of plants suitable for reindeer grazing, or the growth rate of such plants is very slow.

Unsuited. The natural vegetation is not suitable for reindeer grazing.

Commercial forestry

Commercial forest land is defined for most of Alaska as land that is producing or can produce usable crops of industrial wood with annual growth of at least 20 cubic feet per acre (1.4 cubic meters per hectare). In southeastern Alaska and other coastal areas bordering the Gulf of Alaska, it is defined as land that will net a minimum of 8,000 board feet per acre. Important commercial species in interior Alaska and the Cook Inlet-Susitna Lowland are white spruce, paper birch, quaking aspen, and, on flood plains and terraces bordering major streams, cottonwood (balsam poplar). In areas bordering the Gulf of Alaska they are Sitka spruce, western hemlock, and, in the extreme southeast, western redcedar. Noncommercial forests consist principally of black spruce or slow-growing commercial species in areas near tree line or near the northern or western limits of tree growth.

The principal soil factors that adversely affect the growth of commercial tree species are excessive wetness and droughtiness. Noncommercial black spruce forests occupy many poorly drained mineral soils and some organic soils in the interior and the Cook Inlet-Susitna Lowland, but large areas of these soils have only low-growing vegetation. The principal trees on forested poorly drained soils in southeastern Alaska are western hemlock and, in the southern part of the area, western redcedar, but growth rates on these soils are slower than on the well drained soils. Growth rates are reduced by persistent droughtiness on only a few sandy soils on dunes in interior Alaska, but occasional prolonged dry spells affect growth on all soils in the interior.

Climatic factors, specifically low temperatures during the growing season, limit or prevent tree growth in many parts of the State. The altitudinal tree line ranges from a few hundred feet in areas bordering the north coast of the Gulf of Alaska to as much as 3,000 feet (900 m) in east central Alaska. Except for some small areas near the heads of Bristol Bay and Norton Sound and in the lower Noatak Valley, no commercial trees grow in arctic and western Alaska. In the Alaska Peninsula and Southwestern Islands Major Land Resource Area, commercial trees occur only on the northern part of the Kodiak Island group and in areas close to the mouth of Cook Inlet and the head of Iliamna Lake. Commercial species that occur close to the limits of tree growth commonly have slow growth rates.

The following ratings of soil suitability for commercial forestry are based on soil features that affect potential yields and harvesting with modern equipment:

Good. Soil or climatic limitations do not restrict the growth of suitable commercial species or the use of modern harvesting equipment.

Fair. Soil or climatic limitations moderately reduce the growth rate of suitable commercial species or require unusual harvesting operations.

Poor. Soil or climatic limitations are severe enough to make commercial forestry questionable. Growth rates are severely restricted, or harvesting with modern equipment is difficult. Commercial forestry may not be economically feasible.

Unsuited. Soil or climatic limitations prevent the growth of commercial species.

Road location

Soil limitation ratings for road location are based on soil features that affect the design, construction, and performance of roads and highways. Soils with the greatest limitations for roads are those underlain by ice-rich permafrost (fig. 51), organic soils, and other poorly drained soils. High frost action potential, susceptibility to flooding, steep slopes, excessive stoniness, and shallowness over bedrock are also limiting factors. In addition, soils that are subject to severe erosion or to blowing after clearing are considered to have detrimental features for road construction.

The presence of an ice-rich frozen substratum, which thaws and settles unevenly for years after completion of the road, is a major problem in road construction over much of Alaska. Special measures have been developed to prevent this deterioration of the road foundation but add materially to the cost of the road. Common procedures are (1) to provide a thick gravel embankment or other insulating material under the road to prevent thawing of the permafrost, or (2) to allow the road to remain unpaved for several years after initial construction to permit formation of a stable thawed layer between the zone of annual freezing and the permafrost.

Deep organic soils are usually wet throughout the summer and have low load-supporting capacity even when dry. Organic soils with shallow permafrost, however, can be treated much like other frozen soils if the permafrost is preserved at its original level. The limitations of shallow organic soils and poorly drained mineral soils south of the permafrost zone commonly can be overcome, but only by extensive site preparation before construction of the road embankment and by provision for adequate drainage of road ditches.

Except in southeastern Alaska and other areas bordering the Gulf of Alaska, frost action is an important consideration in the design of roads on loamy soils. The problem is most severe in poorly drained soils, but roads on well drained deep silty soils are also highly susceptible to frost damage.

Special precautions are necessary for roads built on soils that are subject to flooding. Loamy soils, especially deep silty soils, on slopes require protection against erosion in road ditches and cuts. Sandy soils are highly susceptible to blowing when the natural vegetation is removed. Revegetation of such soils may be difficult.

The soil limitation ratings are based on the properties of undisturbed soil to a depth of 5 feet (150 cm). It is assumed in determining the ratings that any surface layer of organic material will be removed in construction:

Slight. Soil limitations, if any, are easily overcome.

TABLE 7.—*Estimated acreage of map units in major land*

[Acreages listed represent

Map unit symbol	Major land resource area [1]	Suitability for—															
		Common crops				Rangeland								Commercial forestry			
						Cattle and sheep				Reindeer							
		Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited
CL	171	—	—	105	421	—	105	—	421	—	105	—	421	—	—	—	526
	178	—	—	25	102	—	25	—	102	—	25	—	102	—	—	—	127
DL	176	—	—	—	33	—	—	—	33	—	—	—	33	—	—	—	33
	177	—	—	—	11	—	—	—	11	—	—	—	11	—	—	—	11
EA1	169	—	40	104	59	—	—	199	4	—	—	176	27	60	9	75	59
EA2	170	68	—	305	77	—	—	450	—	—	72	369	9	68	4	301	77
	172	—	—	71	12	—	—	71	12	15	66	—	2	—	—	—	83
EA3	168	—	11	56	45	—	—	70	42	—	—	84	28	11	17	42	42
	169	—	35	175	139	—	—	219	130	—	—	306	43	35	53	131	130
EA4	169	—	158	210	158	—	—	389	137	—	—	436	90	158	74	157	137
EA5	169	—	—	118	174	—	—	139	153	—	—	116	176	15	103	73	101
EF1	169	19	—	26	6	—	1	44	6	—	—	50	1	19	1	25	6
	170	119	—	160	40	—	8	271	40	—	—	311	8	119	8	152	40
	175	88	—	118	30	—	6	200	30	—	106	124	6	88	6	6	136
	178	2	—	69	12	—	2	42	39	2	67	12	2	2	—	2	79
EF2	174	736	—	515	221	—	—	1,251	221	515	221	736	—	736	—	147	589
EO1	170	103	46	34	46	—	—	218	11	—	—	229	—	114	81	23	11
EO2	168	—	—	13	41	—	—	41	13	—	—	14	40	5	35	—	14
	169	—	—	91	515	—	—	454	152	—	61	454	91	—	394	61	151
EO3	176	21	—	505	316	—	—	526	316	505	21	316	—	21	—	295	526
HY1	170	22	5	5	182	—	22	10	182	—	—	214	—	22	5	5	182
HY2	171	—	—	30	268	—	30	268	—	—	30	268	—	—	—	—	298
	178	—	—	97	871	—	97	871	—	—	97	871	—	—	—	—	968
HY3	171	—	—	32	47	—	32	47	—	—	32	47	—	—	—	—	79
	178	—	—	50	74	—	50	74	—	—	50	74	—	—	—	—	124
HY4	172	—	1	3	21	—	—	4	21	4	20	1	—	—	1	—	24
	174	2	—	12	55	—	—	14	55	12	55	2	—	2	—	2	65
	175	3	—	18	81	—	—	21	81	18	81	3	—	3	—	3	96
	177	—	—	2	63	—	—	—	65	11	54	—	—	—	—	—	65
	178	—	—	2	63	—	—	—	65	11	54	—	—	—	—	—	65
HY5	178	—	—	28	258	—	28	100	158	128	158	—	—	—	—	—	286
IA1	171	—	—	821	205	—	855	34	137	188	667	137	34	—	—	—	1,026
IA2	171	—	30	973	766	30	1,238	118	383	442	796	501	30	—	—	60	1,709
IA3	171	—	—	245	27	—	245	27	—	245	—	27	—	—	—	—	272
	178	—	—	626	70	—	626	70	—	626	—	70	—	—	—	—	696
IA4	171	—	—	207	253	—	207	253	—	391	—	69	—	—	—	—	460
	178	—	—	452	552	—	452	552	—	853	—	151	—	—	—	—	1,004
IA5	171	—	—	—	265	—	252	13	—	252	—	13	—	—	—	—	265
IA6	171	—	—	370	65	—	370	65	—	370	—	65	—	—	—	—	435
	178	—	—	176	31	—	176	31	—	176	—	31	—	—	—	—	207
IA7	171	—	—	229	152	—	229	19	133	286	95	—	—	—	—	—	381
	175	—	—	50	33	—	—	54	29	62	21	—	—	—	—	—	83
	178	—	—	196	130	—	196	16	114	245	81	—	—	—	—	—	326

resource areas with indicated suitability and limitation ratings

thousands of acres]

Limitation for—															
Road location				Low buildings				Recreation				Off-road trafficability			
Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe
—	105	421	—	—	105	421	—	105	—	—	421	—	105	421	—
—	25	102	—	—	25	102	—	25	—	—	102	—	25	102	—
—	—	33	—	—	—	33	—	—	—	—	33	—	—	—	33
—	—	11	—	—	—	11	—	—	—	—	11	—	—	—	11
24	20	155	4	24	—	175	4	24	20	104	55	44	—	104	55
4	72	297	77	8	—	365	77	8	68	297	77	72	4	297	77
—	—	60	23	—	—	60	23	—	—	73	10	—	—	73	10
3	11	78	20	3	—	89	20	3	11	56	42	14	—	56	42
9	35	245	60	9	—	280	60	9	35	175	130	44	—	175	130
79	79	310	58	79	—	389	58	79	79	231	137	158	—	231	137
15	29	176	72	15	29	161	87	15	29	132	116	44	—	132	116
1	19	25	6	1	1	43	6	2	18	25	6	20	—	25	6
8	119	152	40	8	8	263	40	16	111	152	40	127	—	152	40
6	88	112	30	6	6	194	30	12	82	112	30	94	—	112	30
2	31	40	10	2	2	69	10	4	29	40	10	33	—	40	10
—	736	147	589	—	—	883	589	—	736	515	221	736	—	515	221
46	103	69	11	46	92	80	11	138	11	69	11	149	—	69	11
—	—	40	14	—	—	40	14	—	—	32	22	—	—	32	22
—	—	455	151	—	—	455	151	—	—	364	242	—	—	364	242
—	21	590	231	—	—	611	231	—	21	800	21	21	—	800	21
—	27	5	182	—	27	5	182	27	—	5	182	27	—	5	182
—	30	8	260	—	30	8	260	30	—	—	268	—	30	—	268
—	97	24	847	—	97	24	847	97	—	—	871	—	97	—	871
—	32	—	47	—	32	—	47	32	—	—	47	—	32	—	47
—	50	—	74	—	50	—	74	50	—	—	74	—	50	—	74
—	1	1	23	—	—	2	23	—	1	4	20	1	—	4	20
—	2	2	65	—	—	4	65	—	2	12	55	2	—	12	55
—	3	3	96	—	—	6	96	—	3	18	81	3	—	18	81
—	2	2	61	—	—	4	61	—	2	11	52	2	—	11	52
—	2	2	61	—	—	4	61	—	2	11	52	2	—	11	52
28	—	100	158	28	—	100	158	28	—	100	158	28	—	100	158
—	—	855	171	—	—	855	171	—	—	855	171	—	—	855	171
—	—	1,328	441	—	—	1,298	471	—	—	1,298	471	—	—	1,298	471
245	—	—	27	245	—	—	27	245	—	—	27	245	—	—	27
626	—	—	70	626	—	—	70	626	—	—	70	626	—	—	70
207	—	184	69	207	—	184	69	207	—	184	69	207	—	184	69
452	—	401	151	452	—	401	151	452	—	401	151	452	—	401	151
—	—	252	13	—	—	252	13	—	—	252	13	—	—	252	13
370	—	—	65	370	—	—	65	370	—	—	65	370	—	—	65
176	—	—	31	176	—	—	31	176	—	—	31	176	—	—	31
229	—	38	114	229	—	38	114	229	—	38	114	229	—	38	114
50	—	8	25	50	—	8	25	50	—	8	25	50	—	8	25
196	—	33	97	196	—	33	97	196	—	33	97	196	—	33	97

TABLE 7.—*Estimated acreage of map units in major land resource*

Map unit symbol	Major land resource area [1]	Suitability for—															
		Common crops				Rangeland								Commercial forestry			
						Cattle and sheep				Reindeer							
		Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited
IA8	175	—	—	601	400	—	—	601	400	901	100	—	—	—	—	—	1,001
IA9	170	—	—	—	156	—	125	16	15	141	—	15	—	—	—	—	156
	171	—	—	—	2,578	—	2,062	258	258	2,320	—	258	—	—	—	—	2,578
	173	—	—	—	84	—	—	76	8	76	—	8	—	—	—	—	84
	175	—	—	—	489	—	—	440	49	440	—	49	—	—	—	—	489
	178	—	—	—	29	—	—	26	3	26	—	3	—	—	—	—	29
	179	—	—	—	62	—	—	56	6	56	—	6	—	—	—	—	62
IA10	171	—	—	—	334	—	167	50	117	317	—	17	—	—	—	—	334
IA11	171	—	—	—	2,241	—	—	1,233	1,008	1,233	—	—	1,008	—	—	—	2,241
IA12	171	—	—	695	298	—	695	298	—	695	—	298	—	—	—	—	993
IA13	175	82	825	495	247	—	—	1,402	247	1,320	247	82	—	82	—	—	1,567
IA14	170	—	—	39	8	1	39	7	—	2	40	5	—	—	—	—	47
	171	—	—	1,237	234	13	1,237	221	—	1,251	73	147	—	—	—	—	1,471
	175	—	—	64	12	1	3	72	—	65	4	7	—	—	—	—	76
IA15	170	—	—	612	153	—	536	229	—	—	574	191	—	115	—	76	574
	171	—	—	38	9	—	33	14	—	24	11	12	—	—	—	—	47
IA16	171	—	—	798	1,196	—	798	598	598	1,396	—	—	598	—	—	—	1,994
	175	—	—	22	32	—	—	38	16	38	—	—	16	—	—	—	54
IA17	171	—	—	—	533	—	53	480	—	506	—	27	—	—	—	—	533
IQ1	172	—	29	292	1,431	—	—	350	1,402	1,461	204	87	—	—	29	58	1,665
IQ2	172	—	24	513	396	—	—	537	396	793	116	24	—	—	24	23	886
	173	—	—	56	42	—	—	56	42	84	12	2	—	—	2	2	94
	174	1,490	—	5,588	373	—	—	7,078	373	5,588	373	1,490	—	1,117	373	1,118	4,843
	175	380	—	6,084	1,142	—	760	5,704	1,142	5,578	127	1,901	—	1,521	380	—	5,705
	176	453	—	7,256	1,363	—	907	6,802	1,363	6,653	152	2,267	—	1,814	453	—	6,805
	177	—	—	—	2,449	—	—	—	2,449	2,265	184	—	—	—	—	—	2,449
	178	—	—	89	3,477	—	—	89	3,477	2,853	624	89	—	—	—	—	3,566
	180	—	—	—	322	—	—	—	322	310	12	—	—	—	—	—	322
	181	—	—	—	15,618	—	—	—	15,618	14,994	624	—	—	—	—	—	15,618
IQ3	173	—	—	65	11	—	—	38	38	34	42	—	—	—	4	—	72
	174	1,969	—	2,813	844	—	—	4,782	844	2,532	844	2,250	—	1,969	281	—	3,376
	175	31	—	43	13	—	—	74	13	39	13	35	—	31	4	—	52
	176	134	—	192	58	—	—	326	58	173	58	153	—	134	19	—	231
	178	—	—	298	554	—	—	43	809	426	426	—	—	—	—	—	852
	181	—	—	—	116	—	—	6	110	58	58	—	—	—	—	—	116
IQ4	174	—	—	68	8	—	—	68	8	45	8	23	—	—	23	—	53
	176	—	—	988	110	—	—	988	110	659	110	329	—	—	329	—	769
IQ5	175	—	—	—	529	—	—	—	529	291	238	—	—	—	—	—	529
	177	—	—	—	1,015	—	—	20	995	630	385	—	—	—	—	20	995
	180	—	—	—	330	—	—	—	330	181	149	—	—	—	—	—	330
IQ6	172	—	1	10	7	—	—	11	7	10	7	1	—	—	1	—	17
	173	—	—	10	8	—	—	10	8	10	8	—	—	—	—	—	18
	174	365	—	4,010	2,916	—	—	4,375	2,916	4,010	2,916	365	—	365	—	—	6,926
	175	85	—	933	678	—	—	1,018	678	933	678	85	—	85	—	—	1,611
	176	98	—	1,074	781	—	—	1,172	781	1,074	781	98	—	98	—	—	1,855
	177	—	—	—	1,627	—	—	—	1,627	936	691	—	—	—	—	—	1,627
	178	—	—	—	9,739	—	—	—	9,739	5,600	4,139	—	—	—	—	—	9,739
	179	—	—	—	709	—	—	—	709	408	301	—	—	—	—	—	709
	180	—	—	—	188	—	—	—	188	104	84	—	—	—	—	—	188
	181	—	—	—	84	—	—	—	84	48	36	—	—	—	—	—	84
	182	—	—	—	5,095	—	—	—	5,095	3,948	1,147	—	—	—	—	—	5,095

areas with indicated suitability and limitation ratings—Continued

Limitation for—															
Road location				Low buildings				Recreation				Off-road trafficability			
Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe
451	—	300	250	451	—	300	250	451	—	450	100	451	—	450	100
—	—	125	31	—	—	125	31	—	—	125	31	—	—	125	31
—	—	2,062	516	—	—	2,062	516	—	—	2,062	516	—	—	2,062	516
—	—	76	8	—	—	76	8	—	—	76	8	—	—	76	8
—	—	391	98	—	—	391	98	—	—	391	98	—	—	391	98
—	—	23	6	—	—	23	6	—	—	23	6	—	—	23	6
—	—	50	12	—	—	50	12	—	—	50	12	—	—	50	12
—	—	284	50	—	—	284	50	—	—	284	50	—	—	284	50
—	—	1,233	1,008	—	—	1,233	1,008	—	—	1,233	1,008	—	—	1,233	1,008
—	695	—	298	—	695	—	298	695	—	—	298	—	695	—	298
—	907	—	742	—	825	82	742	825	82	495	247	82	825	495	247
1	—	39	7	1	—	39	7	—	1	39	7	1	—	39	7
13	—	1,237	221	13	—	1,237	221	—	13	1,237	221	13	—	1,237	221
1	—	64	11	1	—	64	11	—	1	64	11	1	—	64	11
—	38	574	153	—	38	574	153	38	—	574	153	—	38	574	153
—	2	36	9	—	2	36	9	2	—	36	9	—	2	36	9
—	—	798	1,196	—	—	798	1,196	—	—	798	1,196	—	—	798	1,196
—	—	22	32	—	—	22	32	—	—	22	32	—	—	22	32
—	—	53	480	—	—	53	480	—	—	53	480	—	—	53	480
—	29	234	1,489	—	—	263	1,489	—	29	1,548	175	29	—	1,548	175
24	—	303	606	24	—	303	606	24	—	816	93	24	—	816	93
2	—	32	64	2	—	32	64	2	—	86	10	2	—	86	10
—	1,490	1,118	4,843	—	931	1,677	4,843	931	186	5,961	373	1,117	373	5,588	373
—	380	2,536	4,690	—	—	2,916	4,690	380	—	7,099	127	—	380	7,099	127
—	453	3,025	5,594	—	—	3,478	5,594	453	—	8,467	152	—	453	8,467	152
—	—	612	1,837	—	—	612	1,837	—	—	2,326	123	—	—	2,326	123
—	89	446	3,031	—	—	535	3,031	—	89	2,942	535	89	—	2,942	535
—	—	91	231	—	—	91	231	—	—	316	6	—	—	316	6
—	—	4,373	11,245	—	—	4,373	11,245	—	—	15,306	312	—	—	15,306	312
4	27	—	45	4	—	27	45	4	27	34	11	31	—	34	11
281	1,969	—	3,376	281	—	1,969	3,376	281	1,969	2,532	844	2,250	—	2,532	844
4	31	—	52	4	—	31	52	4	31	39	13	35	—	39	13
19	134	—	231	19	—	134	231	19	134	173	58	153	—	173	58
43	298	—	511	43	—	298	511	43	298	383	128	341	—	383	128
6	41	—	69	6	—	41	69	6	41	52	17	47	—	52	17
—	23	—	53	—	19	4	53	23	—	45	8	19	4	45	8
—	329	—	769	—	274	55	769	329	—	659	110	274	55	659	110
—	—	211	318	—	—	211	318	—	79	344	106	—	—	423	106
—	—	589	426	—	—	589	426	—	—	589	426	—	—	589	426
—	—	132	198	—	—	132	198	—	49	215	66	—	—	264	66
—	1	—	17	—	—	1	17	—	1	10	7	1	—	10	7
—	1	—	17	—	—	1	17	—	1	10	7	1	—	10	7
—	365	—	6,926	—	—	365	6,926	—	365	4,010	2,916	365	—	4,010	2,916
—	85	—	1,611	—	—	85	1,611	—	85	933	678	85	—	933	678
—	98	—	1,855	—	—	98	1,855	—	98	1,074	781	98	—	1,074	781
—	—	81	1,546	—	—	81	1,546	—	—	976	651	—	—	976	651
—	—	487	9,252	—	—	487	9,252	—	—	5,843	3,896	—	—	5,843	3,896
—	—	35	674	—	—	35	674	—	—	425	284	—	—	425	284
—	9	—	179	—	—	9	179	—	9	104	75	9	—	104	75
—	—	4	80	—	—	4	80	—	—	50	34	—	—	50	34
—	127	1,274	3,694	—	127	1,274	3,694	—	127	1,274	3,694	—	127	1,274	3,694

TABLE 7.—*Estimated acreage of map units in major land resource*

Map unit symbol	Major land resource area [1]	Suitability for—															
		Common crops				Rangeland								Commercial forestry			
						Cattle and sheep				Reindeer							
		Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited
IQ7	176	—	—	77	180	—	—	77	180	257	—	—	—	—	—	—	257
	177	—	—	—	4,670	—	—	—	4,670	4,670	—	—	—	—	—	—	4,670
	178	—	—	—	105	—	—	—	105	105	—	—	—	—	—	—	105
	181	—	—	—	902	—	—	—	902	902	—	—	—	—	—	—	902
IQ8	174	—	—	14	22	—	—	14	22	31	2	3	—	—	—	3	33
	175	—	—	359	536	—	—	359	536	761	44	90	—	—	—	90	805
	176	—	—	413	620	—	—	413	620	878	52	103	—	—	—	103	930
	177	—	—	—	827	—	—	—	827	760	51	16	—	—	—	—	827
	181	—	—	—	3,980	—	—	—	3,980	3,661	240	79	—	—	—	—	3,980
IQ9	174	198	—	244	15	—	—	442	15	244	15	198	—	152	46	15	244
	175	716	—	882	55	—	—	1,598	55	882	55	716	—	551	165	55	882
	176	1,159	—	1,427	89	—	—	2,586	89	1,427	89	1,159	—	891	268	89	1,427
IQ10	177	—	—	418	628	—	—	418	628	628	261	157	—	—	—	157	889
IQ11	175	—	—	154	357	—	—	154	357	491	20	—	—	—	—	—	511
	177	—	—	—	1,033	—	—	—	1,033	991	42	—	—	—	—	—	1,033
	181	—	—	—	442	—	—	—	442	424	18	—	—	—	—	—	442
IQ12	174	21	2	28	11	—	15	36	11	30	9	23	—	21	2	—	39
	175	270	19	348	135	—	193	444	135	367	116	289	—	270	19	—	483
	177	20	2	16	31	—	34	4	31	31	—	38	—	36	—	2	31
IQ13	175	246	61	1,230	924	—	615	922	924	1,107	186	1,168	—	676	492	—	1,293
	177	65	16	228	343	—	163	146	343	294	49	309	—	179	130	—	343
IQ14	173	—	—	48	61	—	—	46	63	63	46	—	—	—	13	27	69
	174	4	21	120	65	—	—	145	65	120	8	82	—	25	57	—	128
	175	172	29	772	172	—	172	801	172	630	57	458	—	172	286	29	658
	177	7	—	13	27	—	7	13	27	26	2	19	—	7	12	—	28
IQ15	172	—	—	68	157	—	—	68	157	180	45	—	—	—	23	—	202
	173	—	—	15	47	—	—	14	48	46	14	2	—	1	12	1	48
	174	22	87	98	659	—	—	207	659	649	10	207	—	109	87	11	659
	175	22	89	101	680	—	—	212	680	669	11	212	—	111	89	12	680
	176	28	—	—	251	—	—	28	251	244	7	28	—	28	—	—	251
	177	—	—	32	287	—	—	—	319	279	40	—	—	—	—	—	319
	179	—	—	—	946	—	—	—	946	946	—	—	—	—	—	—	946
IQ16	177	—	—	14	399	—	14	—	399	386	14	—	13	—	—	—	413
	178	—	—	—	47	—	—	—	47	44	2	—	1	—	—	—	47
	179	—	—	—	257	—	—	—	257	241	8	—	8	—	—	—	257
IQ17	175	—	20	20	761	—	320	40	441	361	400	—	40	—	40	—	761
IQ18	175	46	—	750	1,216	—	22	975	1,015	1,050	268	672	22	146	23	805	1,038
	176	56	—	917	1,490	—	27	1,192	1,244	1,285	329	822	27	178	28	985	1,272
	177	11	—	315	616	—	10	399	533	491	137	304	10	57	11	330	544
	180	—	—	25	47	—	1	23	48	44	4	23	1	4	1	18	49
IQ19	175	207	—	1,448	2,481	—	207	1,448	2,481	2,277	481	1,241	137	207	1,034	—	2,895
IQ20	181	—	—	—	518	—	—	—	518	466	52	—	—	—	—	—	518
	182	—	—	—	152	—	—	—	152	137	15	—	—	—	—	—	152
IQ21	182	—	—	—	2,367	—	—	—	2,367	2,249	59	—	59	—	—	—	2,367
IQ22	180	—	—	—	72	—	—	—	72	70	1	—	1	—	—	—	72
	181	—	—	—	1,338	—	—	—	1,338	1,305	17	—	16	—	—	—	1,338
	182	—	—	—	1,265	—	—	—	1,265	1,233	16	—	16	—	—	—	1,265
IQ23	175	—	—	241	2,170	—	—	241	2,170	1,929	241	241	—	—	—	241	2,170

areas with indicated suitability and limitation ratings—Continued

Limitation for—															
Road location				Low buildings				Recreation				Off-road trafficability			
Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe
39	5	97	116	39	5	97	116	44	—	213	—	44	—	174	39
701	94	1,773	2,102	701	94	1,773	2,102	795	—	3,875	—	795	—	3,174	701
16	2	39	48	16	2	39	48	18	—	87	—	18	—	71	16
135	18	343	406	135	18	343	406	153	—	749	—	153	—	614	135
—	—	24	12	—	—	24	12	—	—	35	1	—	—	35	1
—	—	604	291	—	—	604	291	—	—	873	22	—	—	873	22
—	—	697	336	—	—	697	336	—	—	1,007	26	—	—	1,007	26
—	—	422	405	—	—	422	405	—	—	794	33	—	—	794	33
—	—	2,030	1,950	—	—	2,030	1,950	—	—	3,821	159	—	—	3,821	159
—	198	15	244	—	152	61	244	198	—	244	15	152	46	244	15
—	716	55	882	—	551	220	882	716	—	882	55	551	165	882	55
—	1,159	89	1,427	—	891	357	1,427	1,159	—	1,427	89	891	268	1,427	89
—	—	523	523	—	—	523	523	—	—	1,046	—	—	—	1,046	—
—	—	270	241	—	—	270	241	—	—	501	10	—	—	424	87
—	—	547	486	—	—	547	486	—	—	1,012	21	—	—	857	176
—	—	234	208	—	—	234	208	—	—	433	9	—	—	367	75
—	23	—	39	—	17	6	39	17	6	28	11	23	—	28	11
—	289	—	483	—	212	77	483	212	77	348	135	289	—	348	135
4	20	24	21	4	20	24	21	24	—	45	—	24	—	45	—
61	246	923	1,231	61	—	1,169	1,231	307	—	1,292	862	61	246	1,292	862
16	65	244	327	16	—	309	327	81	—	342	229	16	65	342	229
13	2	59	35	13	—	61	35	13	2	92	2	15	—	92	2
25	4	114	67	25	—	118	67	25	4	177	4	29	—	177	4
—	172	486	487	—	172	486	487	172	—	944	29	172	—	944	29
—	7	20	20	—	7	20	20	7	—	39	1	7	—	39	1
23	11	124	67	23	11	124	67	23	11	169	22	34	—	169	22
13	1	47	1	13	—	48	1	13	1	47	1	13	1	47	1
185	11	660	10	185	—	671	10	185	11	660	10	185	11	660	10
189	11	681	11	189	—	692	11	189	11	681	11	189	11	681	11
—	28	244	7	—	—	272	7	—	28	244	7	28	—	244	7
—	32	279	8	—	—	311	8	—	32	279	8	32	—	279	8
—	—	804	142	—	—	804	142	—	—	946	—	—	—	946	—
—	41	345	27	—	41	345	27	41	—	359	13	41	—	372	—
—	5	39	3	—	5	39	3	5	—	41	1	5	—	42	—
—	26	214	17	—	26	214	17	26	—	223	8	26	—	231	—
20	20	681	80	20	—	701	80	20	20	681	80	40	—	681	80
—	46	1,944	22	—	23	1,967	22	46	—	1,944	22	23	23	1,944	22
—	56	2,380	27	—	28	2,408	27	56	—	2,380	27	28	28	2,380	27
—	22	910	10	—	11	921	10	22	—	910	10	11	11	910	10
—	2	69	1	—	1	70	1	2	—	69	1	1	1	69	1
—	207	3,241	688	—	207	3,241	688	207	—	3,655	274	207	—	3,655	274
—	—	259	259	—	—	259	259	—	—	518	—	—	—	337	181
—	—	76	76	—	—	76	76	—	—	152	—	—	—	99	53
—	710	1,243	414	—	710	1,243	414	—	710	1,539	118	—	710	1,539	118
7	1	61	3	7	1	61	3	7	1	62	2	7	1	63	1
134	16	1,138	50	134	16	1,138	50	134	16	1,155	33	134	16	1,171	17
127	16	1,074	48	127	16	1,074	48	127	16	1,090	32	127	16	1,106	16
241	—	2,170	—	241	—	2,170	—	241	—	2,170	—	241	—	2,170	—

TABLE 7.—*Estimated acreage of map units in major land resource*

Map unit symbol	Major land resource area [1]	Suitability for—															
		Common crops				Rangeland								Commercial forestry			
						Cattle and sheep				Reindeer							
		Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited
IQ24	176	—	—	13	999	—	—	13	999	570	378	64	—	—	—	13	999
	177	—	—	55	4,349	—	—	55	4,349	2,478	1,651	275	—	—	—	55	4,349
	180	—	—	—	2,567	—	—	—	2,567	1,444	963	160	—	—	—	32	2,535
	181	—	—	—	2,338	—	—	—	2,338	1,316	876	146	—	—	—	29	2,309
IQ25	169	—	—	4	152	—	—	4	152	125	23	4	4	—	—	4	152
	172	—	—	1	13	—	—	1	13	11	2	1	—	—	—	1	13
	173	—	—	58	2,248	—	—	58	2,248	1,844	346	58	58	—	—	58	2,248
	176	168	—	170	9,831	—	—	592	9,577	8,814	1,017	338	—	—	168	170	9,831
IQ26	173	—	—	—	424	—	—	—	424	276	85	—	63	—	—	—	424
	175	—	—	—	1,917	—	—	—	1,917	1,246	383	—	288	—	—	—	1,917
IR1	174	1,778	—	240	34	—	—	2,052	—	205	—	1,847	—	1,368	410	69	205
IR2	174	524	—	77	15	—	—	601	15	77	15	524	—	524	—	15	77
	176	275	—	40	8	—	—	315	8	40	8	275	—	275	—	8	40
IR3	174	100	22	33	66	—	—	221	—	—	—	221	—	78	77	66	—
	175	86	19	29	58	—	—	192	—	—	—	192	—	67	67	58	—
IR4	172	8	50	25	—	—	—	83	—	25	8	50	—	8	50	—	25
	174	1,175	—	504	—	—	—	1,679	—	504	—	1,175	—	1,175	—	—	504
	176	155	—	66	—	—	—	221	—	66	—	155	—	155	—	—	66
IR5	172	—	201	14	54	—	—	215	54	40	135	94	—	—	108	107	54
IR6	173	7	—	52	6	—	—	59	6	19	3	43	—	23	10	10	22
	174	7	—	58	8	—	—	65	8	22	4	47	—	25	11	11	26
	175	95	—	757	94	—	—	852	94	284	47	615	—	331	142	142	331
	176	277	—	2,218	277	—	—	2,495	277	832	138	1,802	—	970	416	416	970
	177	43	—	237	151	—	—	280	151	130	21	280	—	151	64	65	151
IR7	174	6	91	—	146	—	—	231	12	73	12	158	—	6	91	61	85
	176	5	75	—	120	—	—	190	10	60	10	130	—	5	75	50	70
	177	—	45	3	72	—	—	111	9	36	9	75	—	—	45	30	45
IR8	174	—	241	27	—	—	—	268	—	13	—	255	—	241	—	27	—
IR9	169	—	1	10	3	—	—	11	3	2	2	10	—	—	11	—	3
	172	—	14	198	71	—	—	212	71	43	120	120	—	—	212	—	71
	176	5	44	33	27	—	—	82	27	16	11	82	—	49	33	—	27
IR10	172	11	1	26	6	—	—	38	6	11	4	29	—	—	27	2	15
	173	21	3	50	10	—	—	74	10	21	6	57	—	—	53	4	27
	174	249	307	264	58	—	—	820	58	220	58	600	—	336	220	88	234
IR11	169	8	16	205	86	—	—	245	70	62	24	229	—	8	16	221	70
	172	—	30	259	109	—	—	309	89	80	49	269	—	—	30	279	89
	173	—	5	61	25	—	—	69	22	18	11	62	—	—	5	64	22
	174	3	—	23	10	—	—	27	9	8	2	26	—	3	—	24	9
IR12	173	14	—	412	246	—	—	412	260	372	42	244	14	—	56	202	414
	174	2	—	18	13	—	—	20	13	19	2	12	—	1	2	10	20
	175	64	—	907	562	—	—	971	562	849	64	588	32	32	128	460	913
	176	501	—	7,113	4,409	—	—	7,614	4,409	6,664	501	4,608	250	250	1,001	3,607	7,165
IR13	173	—	—	28	30	—	—	33	25	25	5	26	2	—	—	31	27
	174	—	—	64	70	—	—	78	56	56	14	60	4	—	—	74	60
	175	—	—	26	28	—	—	30	24	24	4	24	2	—	—	28	26
	176	—	—	866	939	—	—	1,047	758	758	181	812	54	—	—	993	812
	177	—	—	263	322	—	—	321	264	247	58	263	17	—	—	321	264
IR14	176	539	—	1,402	216	—	—	1,977	180	575	36	1,546	—	216	1,294	36	611

areas with indicated suitability and limitation ratings—Continued

Limitation for—															
Road location				Low buildings				Recreation				Off-road trafficability			
Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe
—	—	961	51	—	—	961	51	—	—	961	51	—	—	961	51
—	—	4,184	220	—	—	4,184	220	—	—	4,184	220	—	—	4,184	220
—	—	2,439	128	—	—	2,439	128	—	—	2,439	128	—	—	2,439	128
—	—	2,221	117	—	—	2,221	117	—	—	2,221	117	—	—	2,221	117
—	—	152	4	—	—	152	4	—	—	152	4	—	—	152	4
—	—	14	—	—	—	14	—	—	—	14	—	—	—	14	—
—	—	2,248	58	—	—	2,248	58	—	—	2,248	58	—	—	2,248	58
—	168	9,493	508	—	—	9,661	508	168	—	9,747	254	—	168	9,747	254
—	—	361	63	—	—	361	63	—	—	361	63	—	—	361	63
—	—	1,629	288	—	—	1,629	288	—	—	1,629	288	—	—	1,629	288
—	1,813	34	205	35	1,334	478	205	1,779	34	239	—	1,368	445	239	—
—	524	15	77	—	524	15	77	524	—	77	15	524	—	77	15
—	275	8	40	—	275	8	40	275	—	40	8	275	—	40	8
22	100	99	—	22	78	121	—	122	—	99	—	100	22	99	—
19	86	87	—	19	67	106	—	105	—	87	—	86	19	87	—
—	58	—	25	—	50	8	25	58	—	25	—	50	8	25	—
—	1,175	—	504	—	1,007	168	504	1,175	—	504	—	1,007	168	504	—
—	155	—	66	—	133	22	66	155	—	66	—	133	22	66	—
—	201	14	54	—	201	14	54	201	—	54	14	201	—	54	14
—	7	39	19	—	—	46	19	7	—	55	3	—	7	55	3
—	7	44	22	—	—	51	22	7	—	62	4	—	7	62	4
—	95	567	284	—	—	662	284	95	—	804	47	—	95	804	47
—	277	1,664	831	—	—	1,941	831	277	—	2,357	138	—	277	2,357	138
—	43	259	129	—	—	302	129	43	—	367	21	—	43	367	21
91	6	134	12	91	—	140	12	91	6	134	12	97	—	134	12
75	5	110	10	75	—	115	10	75	5	110	10	80	—	110	10
45	3	66	6	45	—	69	6	45	3	66	6	48	—	66	6
241	14	13	—	255	—	13	—	255	—	13	—	241	14	13	—
10	1	2	1	10	1	2	1	11	—	2	1	11	—	2	1
198	14	43	28	198	7	50	28	205	7	43	28	212	—	43	28
77	5	16	11	77	3	18	11	80	2	16	11	82	—	16	11
15	14	2	13	17	1	13	13	29	—	11	4	16	13	11	4
29	28	4	23	33	3	25	23	57	—	21	6	32	25	21	6
307	293	44	234	351	29	264	234	600	—	220	58	336	264	220	58
—	24	283	8	—	16	291	8	16	8	283	8	24	—	283	8
—	30	359	9	—	20	369	9	20	10	359	9	30	—	359	9
—	7	82	2	—	5	84	2	5	2	82	2	7	—	82	2
—	3	32	1	—	2	33	1	2	1	32	1	3	—	32	1
—	28	448	196	—	—	476	196	14	14	616	28	14	14	616	28
—	2	22	9	—	—	24	9	1	1	30	1	1	1	30	1
—	64	1,022	447	—	—	1,086	447	32	32	1,405	64	32	32	1,405	64
—	501	8,016	3,506	—	—	8,517	3,506	251	250	11,022	500	250	251	11,022	500
—	—	54	4	—	—	54	4	—	—	56	2	—	—	56	2
—	—	126	8	—	—	126	8	—	—	130	4	—	—	130	4
—	—	50	4	—	—	50	4	—	—	52	2	—	—	52	2
—	—	1,697	108	—	—	1,697	108	—	—	1,751	54	—	—	1,751	54
—	—	550	35	—	—	550	35	—	—	568	17	—	—	568	17
—	539	1,151	467	—	216	1,474	467	539	—	1,582	36	216	323	1,582	36

TABLE 7.—*Estimated acreage of map units in major land resource*

Map unit symbol	Major land resource area [1]	Suitability for—															
		Common crops				Rangeland								Commercial forestry			
						Cattle and sheep				Reindeer							
		Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited
IU1	175	—	35	310	688	—	—	345	688	895	103	35	—	—	35	—	998
IU2	169	—	—	—	45	—	—	1	44	45	—	—	—	—	—	—	45
	172	—	—	—	668	—	—	17	651	668	—	—	—	—	—	—	668
	175	—	—	70	637	—	—	70	637	531	159	—	17	—	—	—	707
	176	—	—	37	333	—	—	37	333	277	84	—	9	—	—	—	370
	177	—	—	784	7,058	—	—	784	7,058	5,882	1,764	—	196	—	—	—	7,842
	178	—	—	13	117	—	—	13	117	97	30	—	3	—	—	—	130
	179	—	—	25	225	—	—	25	225	187	57	—	6	—	—	—	250
	181	—	—	17	157	—	—	17	157	131	39	—	4	—	—	—	174
IU3	169	—	—	—	2,614	—	—	—	3,614	1,732	98	—	784	—	—	—	2,614
	172	—	—	—	498	—	—	—	498	330	19	—	149	—	—	—	498
	173	—	—	—	167	—	—	—	167	110	7	—	50	—	—	—	167
	175	—	—	—	4,467	—	—	—	4,467	2,959	168	—	1,340	—	—	—	4,467
	177	—	—	—	1,287	—	—	—	1,287	852	49	—	386	—	—	—	1,287
	179	—	—	—	224	—	—	—	224	148	9	—	67	—	—	—	224
LF	171	—	—	—	18	—	—	—	18	4	—	—	14	—	—	—	18
	177	—	—	—	123	—	—	—	123	25	—	—	98	—	—	—	123
MA1	182	—	—	—	3,444	—	—	—	3,444	3,100	344	—	—	—	—	—	3,444
MA2	180	—	—	—	1,033	—	—	—	1,033	981	52	—	—	—	—	—	1,033
MA3	180	—	—	—	1,403	—	—	—	1,403	1,263	140	—	—	—	—	—	1,403
	181	—	—	—	793	—	—	—	793	714	79	—	—	—	—	—	793
MB1	176	37	296	—	37	—	—	333	37	37	296	37	—	37	—	296	37
MB2	179	—	—	—	174	—	—	—	174	139	23	—	12	—	—	—	174
	180	—	—	—	696	—	—	—	696	557	93	—	46	—	—	—	696
	181	—	—	—	4,898	—	—	—	4,898	3,919	653	—	326	—	—	—	4,898
RM1	168	—	—	—	8,361	—	—	—	8,361	—	—	—	8,361	—	—	—	8,361
	169	—	—	—	21,174	—	—	—	21,174	—	—	1,059	20,115	—	—	—	21,174
	170	—	—	—	44	—	—	—	44	—	—	4	40	—	—	—	44
	171	—	—	—	6,730	—	—	—	6,730	—	—	67	6,663	—	—	—	6,730
	173	—	—	—	12,528	—	—	—	12,528	—	—	626	11,902	—	—	—	12,528
	175	—	—	—	959	—	—	—	959	—	—	96	863	—	—	—	959
	176	—	—	—	174	—	—	—	174	—	—	17	157	—	—	—	174
	178	—	—	—	18	—	—	—	18	—	—	2	16	—	—	—	18
	179	—	—	—	7	—	—	—	7	—	—	1	6	—	—	—	7
	180	—	—	—	17,731	—	—	—	17,731	—	—	887	16,844	—	—	—	17,731
	181	—	—	—	47	—	—	—	47	—	—	5	42	—	—	—	47
RM2	176	—	—	—	924	—	—	27	897	223	285	—	416	—	—	27	897
	177	—	—	—	953	—	—	28	925	230	294	—	429	—	—	28	925
	180	—	—	—	4,745	—	—	—	4,745	1,288	1,322	—	2,135	—	—	—	4,745
	181	—	—	—	240	—	—	—	240	65	67	—	108	—	—	—	240
SH1	168	5	—	181	115	—	—	115	186	15	—	70	216	161	15	15	110
SO1	170	878	390	878	780	48	1,121	1,026	731	49	—	2,877	—	1,463	98	293	1,072
SO2	170	45	30	242	136	—	204	113	136	—	—	453	—	272	14	24	143
SO3	174	34	138	137	35	—	—	344	—	103	—	241	—	34	138	69	103
	175	12	50	49	13	—	—	124	—	37	—	87	—	12	50	25	37
SO4	170	9	104	57	91	—	—	183	78	—	—	261	—	139	—	31	91
SO5	169	1	4	4	20	—	1	8	20	—	13	16	—	18	1	2	8
	170	11	69	263	114	—	11	332	114	—	—	457	—	286	11	35	125

areas with indicated suitability and limitation ratings—Continued

Limitation for—															
Road location				Low buildings				Recreation				Off-road trafficability			
Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe
—	552	68	413	—	517	103	413	517	35	378	103	552	—	378	103
—	—	44	1	—	—	44	1	—	—	45	—	—	—	45	—
—	—	651	17	—	—	651	17	—	—	668	—	—	—	668	—
—	—	690	17	—	—	690	17	—	—	690	17	—	—	690	17
—	—	361	9	—	—	361	9	—	—	361	9	—	—	361	9
—	—	7,646	196	—	—	7,646	196	—	—	7,646	196	—	—	7,646	196
—	—	127	3	—	—	127	3	—	—	127	3	—	—	127	3
—	—	244	6	—	—	244	6	—	—	244	6	—	—	244	6
—	—	170	4	—	—	170	4	—	—	170	4	—	—	170	4
—	—	1,830	784	—	—	1,830	784	—	—	1,830	784	—	—	1,830	784
—	—	349	149	—	—	349	149	—	—	349	149	—	—	349	149
—	—	117	50	—	—	117	50	—	—	117	50	—	—	117	50
—	—	3,127	1,340	—	—	3,127	1,340	—	—	3,127	1,340	—	—	3,127	1,340
—	—	901	386	—	—	901	386	—	—	901	386	—	—	901	386
—	—	157	67	—	—	157	67	—	—	157	67	—	—	157	67
—	—	18	—	—	—	18	—	—	—	18	—	—	14	4	—
—	—	123	—	—	—	123	—	—	—	123	—	—	98	25	—
345	86	1,119	1,894	345	86	1,119	1,894	345	86	2,669	344	345	86	1,980	1,033
26	—	852	155	26	—	852	155	26	—	955	52	26	—	955	52
—	—	1,017	386	—	—	1,017	386	—	—	1,228	175	—	—	1,228	175
—	—	575	218	—	—	575	218	—	—	694	99	—	—	694	99
—	333	37	—	—	333	37	—	333	—	37	—	333	—	37	—
—	—	156	18	—	—	156	18	—	—	156	18	—	—	156	18
—	—	627	69	—	—	627	69	—	—	627	69	—	—	627	69
—	—	4,409	489	—	—	4,409	489	—	—	4,409	489	—	—	4,409	489
—	—	—	8,361	—	—	—	8,361	—	—	—	8,361	—	—	—	8,361
—	—	—	21,174	—	—	—	21,174	—	—	—	21,174	—	—	—	21,174
—	—	—	44	—	—	—	44	—	—	—	44	—	—	—	44
—	—	—	6,730	—	—	—	6,730	—	—	—	6,730	—	—	—	6,730
—	—	—	12,528	—	—	—	12,528	—	—	—	12,528	—	—	—	12,528
—	—	—	959	—	—	—	959	—	—	—	959	—	—	—	959
—	—	—	174	—	—	—	174	—	—	—	174	—	—	—	174
—	—	—	18	—	—	—	18	—	—	—	18	—	—	—	18
—	—	—	7	—	—	—	7	—	—	—	7	—	—	—	7
—	—	—	17,731	—	—	—	17,731	—	—	—	17,731	—	—	—	17,731
—	—	—	47	—	—	—	47	—	—	—	47	—	—	—	47
—	—	481	443	—	—	481	443	—	—	481	443	—	—	481	443
—	—	496	457	—	—	496	457	—	—	496	457	—	—	496	457
—	—	2,474	2,271	—	—	2,474	2,271	—	—	2,474	2,271	—	—	2,474	2,271
—	—	125	115	—	—	125	115	—	—	125	115	—	—	125	115
15	20	171	95	15	—	191	95	15	5	171	110	20	—	171	110
391	976	828	731	391	976	828	731	1,367	—	585	974	1,318	49	585	974
30	52	235	136	30	52	235	136	82	—	228	143	82	—	228	143
138	34	69	103	138	34	69	103	172	—	172	—	172	—	172	—
50	12	25	37	50	12	25	37	62	—	62	—	62	—	62	—
104	9	70	78	104	—	79	78	104	9	57	91	113	—	70	78
5	1	16	7	5	1	16	7	6	—	15	8	6	—	15	8
80	11	252	114	80	11	252	114	91	—	241	125	91	—	241	125

TABLE 7.—*Estimated acreage of map units in major land resource*

Map unit symbol	Major land resource area [1]	Suitability for—															
		Common crops				Rangeland								Commercial forestry			
						Cattle and sheep				Reindeer							
		Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited	Good	Fair	Poor	Unsuited
SO6	169	—	—	120	485	—	—	120	485	—	363	91	151	60	91	182	272
	175	—	—	172	114	—	—	215	71	86	114	86	—	—	86	43	157
SO7	175	—	—	539	658	—	179	719	299	180	1,017	—	—	—	—	539	658
	178	—	—	28	34	—	9	37	16	9	53	—	—	—	—	28	34
SO8	170	—	—	108	19	—	108	—	19	—	—	127	—	19	—	89	19
	173	—	—	219	38	—	219	—	38	—	—	257	—	39	—	180	38
SO9	170	—	—	215	159	—	187	37	150	—	—	374	—	37	—	178	159
SO10	169	—	—	759	288	—	—	785	262	105	131	52	759	733	—	131	183
	170	—	—	323	69	—	274	59	59	39	10	333	10	39	—	284	69
	172	—	—	161	60	—	155	12	54	22	28	166	5	—	—	183	38
	175	—	—	—	1,062	—	743	266	53	266	637	106	53	—	—	—	1,062
SO11	171	—	—	—	185	102	—	18	65	18	65	102	—	—	—	—	185
	175	—	—	—	101	—	56	10	35	10	91	—	—	—	—	—	101
SO12	169	—	—	1,294	647	—	65	1,035	841	—	—	518	1,423	647	777	—	517
SO13	170	—	—	49	70	—	48	2	69	25	15	49	30	1	—	49	69
	173	—	—	250	374	—	250	4	370	132	86	250	156	—	—	262	362
	175	—	—	10	766	—	310	15	451	164	408	10	194	—	10	5	761
SO14	176	—	—	—	188	—	—	—	188	188	—	—	—	—	—	—	188
SO15	171	—	—	—	18	—	—	—	18	15	3	—	—	—	—	—	18
	172	—	—	—	457	—	—	—	457	388	69	—	—	—	—	—	457
	173	—	—	—	109	—	—	—	109	93	16	—	—	—	—	—	109
	174	—	—	—	366	—	—	—	366	311	55	—	—	—	—	—	366
	175	—	—	—	138	—	—	—	138	117	21	—	—	—	—	—	138
SO16	172	—	—	—	2,626	—	—	656	1,970	2,233	328	—	65	—	—	—	2,626
SO17	172	—	—	—	402	—	—	—	402	221	60	12	109	—	—	—	402
	173	—	—	—	1,130	—	—	—	1,130	622	169	34	305	—	—	—	1,130
	175	—	—	—	566	—	—	—	566	311	85	17	153	—	—	—	566
SO18	168	—	—	4,462	5,453	—	—	3,718	6,197	—	—	2,479	7,436	2,727	3,965	496	2,727
	169	—	—	34	42	—	—	27	49	—	—	18	58	21	31	3	21
All Units	168	5	11	4,712	14,015	—	—	3,944	14,799	15	—	2,647	16,081	2,904	4,032	553	11,254
	169	28	254	3,154	26,607	—	67	3,680	26,296	2,071	715	3,535	23,722	1,774	1,561	1,065	25,643
	170	1,255	644	3,290	2,144	49	2,683	2,953	1,648	256	711	6,269	97	2,694	221	1,540	2,878
	171	—	30	5,780	16,843	145	8,608	4,014	9,886	9,953	1,877	2,055	8,768	—	—	60	22,593
	172	19	351	1,641	6,988	—	155	2,584	6,260	6,535	1,280	854	330	8	505	653	7,833
	173	42	8	1,324	17,588	—	469	949	17,544	3,845	898	1,669	12,550	63	155	841	17,903
	174	8,685	909	14,955	6,010	—	15	24,818	5,726	15,387	4,623	10,545	4	8,287	1,818	1,810	18,644
	175	2,605	1,147	17,602	25,472	1	3,586	20,627	22,612	27,877	6,557	9,229	3,163	4,385	3,056	2,541	36,844
	176	3,911	415	24,807	24,302	—	934	29,053	23,448	32,566	4,782	15,141	946	5,121	4,084	7,088	37,142
	177	146	63	2,380	28,341	—	228	2,579	28,123	22,278	5,756	1,736	1,160	430	262	1,008	29,230
	178	2	—	2,149	16,283	—	1,661	1,964	14,809	11,201	5,806	1,303	124	2	—	30	18,402
	179	—	—	25	2,604	—	—	81	2,548	2,125	398	7	99	—	—	—	2,629
	180	—	—	25	29,134	—	1	23	29,135	6,242	2,820	1,070	19,027	4	1	50	29,104
	181	—	—	17	31,471	—	—	23	31,465	28,003	2,759	230	496	—	—	29	31,441
	182	—	—	—	12,323	—	—	—	12,323	10,667	1,581	—	75	—	—	—	12,323
Total		16,698	8,832	81,861	260,125	195	18,407	97,292	246,622	179,021	40,563	56,290	86,642	25,672	15,695	17,268	303,881

[1] Major land resource areas:

Southern Alaska

168 Southeastern Alaska
169 South Central Alaska Mountains
170 Cook Inlet-Susitna Lowland
171 Alaska Peninsula and Southwestern Islands

areas with indicated suitability and limitation ratings—Continued

Limitation for—															
Road location				Low buildings				Recreation				Off-road trafficability			
Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe	Slight	Moderate	Severe	Very severe
—	—	514	91	—	—	514	91	—	—	514	91	—	—	514	91
—	—	243	43	—	—	243	43	—	—	286	—	—	—	286	—
—	539	179	479	—	539	179	479	539	—	359	299	539	—	359	299
—	28	9	25	—	28	9	25	28	—	18	16	28	—	18	16
—	—	108	19	—	—	108	19	—	—	108	19	—	—	108	19
—	—	219	38	—	—	219	38	—	—	219	38	—	—	219	38
—	—	224	150	—	—	224	150	—	—	215	159	—	—	224	150
—	—	969	78	—	—	969	78	—	—	969	78	—	—	969	78
—	—	362	30	—	—	362	30	—	—	362	30	—	—	362	30
—	—	205	16	—	—	205	16	—	—	205	16	—	—	205	16
—	—	849	213	—	—	849	213	—	—	1,009	53	—	—	1,009	53
—	—	102	83	—	—	102	83	—	—	102	83	—	—	102	83
—	—	56	45	—	—	56	45	—	—	56	45	—	—	56	45
—	—	1,715	226	—	—	1,650	291	—	—	1,068	873	—	—	1,068	873
—	—	88	31	—	—	88	31	—	—	88	31	—	—	88	31
—	—	464	160	—	—	464	160	—	—	464	160	—	—	464	160
—	—	577	199	—	—	577	199	—	—	577	199	—	—	577	199
—	113	75	—	—	113	75	—	—	113	75	—	—	113	75	—
—	8	8	2	—	8	8	2	2	6	8	2	8	—	8	2
—	206	194	57	—	206	194	57	46	160	194	57	206	—	194	57
—	49	47	13	—	49	47	13	11	38	47	13	49	—	47	13
—	165	155	46	—	165	155	46	37	128	155	46	165	—	155	46
—	62	59	17	—	62	59	17	14	48	59	17	62	—	59	17
—	66	1,708	852	—	66	1,708	852	—	66	2,364	196	66	—	2,364	196
—	—	281	121	—	—	281	121	—	—	281	121	—	—	281	121
—	—	791	339	—	—	791	339	—	—	791	339	—	—	791	339
—	—	396	170	—	—	396	170	—	—	396	170	—	—	396	170
248	—	5,453	4,214	248	—	4,462	5,205	248	—	3,471	6,196	248	—	3,471	6,196
2	—	42	32	2	—	34	40	2	—	26	48	2	—	26	48
266	31	5,742	12,704	266	—	4,782	13,695	266	16	3,730	14,731	282	—	3,730	14,731
145	208	6,933	22,757	145	48	7,005	22,845	164	189	5,935	23,755	353	—	5,935	23,755
664	1,407	3,428	1,834	668	1,204	3,627	1,834	1,871	200	3,145	2,117	1,980	91	3,167	2,095
1,064	872	8,917	11,800	1,064	872	8,887	11,830	1,917	19	8,458	12,259	1,072	878	8,865	11,838
260	631	4,542	3,566	262	562	4,609	3,566	606	285	7,187	921	870	21	7,187	921
61	150	5,088	13,663	65	57	5,177	13,663	126	85	5,422	13,329	164	47	5,422	13,329
1,290	8,957	2,867	17,445	1,383	4,292	7,439	17,445	6,425	3,449	16,086	4,599	8,892	1,355	15,713	4,599
1,092	4,611	24,115	17,008	1,092	3,193	25,533	17,008	5,196	507	34,578	6,545	3,907	1,796	34,501	6,622
210	4,654	31,436	17,135	210	2,271	33,819	17,135	4,213	730	45,394	3,098	2,906	1,958	45,434	3,137
766	329	20,607	9,228	766	173	20,763	9,228	1,058	37	26,954	2,881	976	217	26,013	3,724
1,539	627	1,872	14,396	1,539	209	2,290	14,396	1,748	418	10,049	6,219	1,994	172	10,136	6,132
—	26	1,660	943	—	26	1,660	943	26	—	2,201	402	26	—	2,209	394
33	12	7,762	21,352	33	2	7,772	21,352	35	59	8,489	20,576	43	2	8,539	20,575
275	75	15,881	15,257	275	34	15,922	15,257	293	57	29,703	1,435	334	16	29,403	1,735
472	939	4,786	6,126	472	939	4,786	6,126	472	939	6,724	4,188	472	939	5,998	4,914
8,137	23,529	145,636	185,214	8,240	13,882	154,071	186,323	24,416	6,990	214,055	117,055	24,271	7,492	212,252	118,501

Interior Alaska

172 Copper River Plateau
173 Alaska Range
174 Interior Alaska Lowlands
175 Kuskokwim Highlands
176 Interior Alaska Highlands

Arctic and Western Alaska

177 Norton Sound Highlands
178 Western Alaska Coastal Plains and Deltas
179 Bering Sea Islands
180 Brooks Range
181 Arctic Foothills
182 Arctic Coastal Plain

Figure 49.—First crop of barley on cleared field. Near Delta Junction.

Moderate. Soil limitations can be overcome but result in difficult and costly modifications in road design and construction.

Severe. Soil limitations are difficult to overcome and may affect road alignment and location. Special design requirements may result in excessive construction costs.

Very severe. Soil limitations are so difficult or expensive to overcome that the soils should be avoided if possible.

Low buildings

Low buildings refers to buildings with relatively light foundation loads, such as residences, small commercial buildings, service buildings, and picnic area shelters. Large commercial and industrial buildings in which foundations are likely to be well in excess of 5 feet (150 cm) deep are not considered.

Soil properties that adversely affect the suitability of soils as a foundation for low buildings are impeded internal drainage, ice-rich permafrost, high potential frost action, steep slopes, excessive stoniness, and shallow bedrock. Organic soils and soils subject to flooding are considered to have severe limitations. Another important consideration is susceptibility of the soils to wind and water erosion after flooding.

Over much of interior, western, and arctic Alaska a major problem affecting the construction of low buildings is the presence of a perennially frozen substratum. When the native vegetation is removed or even compacted, the upper layers of frozen ground thaw and the soil above it settles unevenly or, in places where the permafrost is discontinuous, becomes pitted. This uneven settling and pitting results in loss of support for footings or foundations of buildings. Special measures that commonly include support pilings imbedded deeply into the permafrost, provision of an air space beneath buildings to reduce thaw, and aboveground utility lines have been developed for construc-

Figure 50.—Hayfield near Palmer.

tion on permafrost. Such measures involve much additional expense both in construction and in later maintenance of the buildings. Potential damage to structures is most severe on loamy soils in which the proportion of ice in relation to soil material in the permafrost is high. In well drained sandy and very gravelly soil with a deep permafrost table and little solid ice, the problems are not so great and may even be negligible.

Soils with poor internal drainage and a high water table are unsatisfactory sites for buildings. In most of interior, western, and arctic Alaska poorly drained soils almost invariably have underlying permafrost (in many places the impermeable permafrost is the direct cause of the poor soil drainage), and problems of wet soils are compounded by problems of frozen ground. In some places, both in southern Alaska and in areas with permafrost, the problems associated with wet soils can be alleviated by artificial drainage or diversion of seep water. In most areas of poorly drained soils in Alaska, however, drainage is either not feasible or is possible only at excessive cost.

Potential frost action is a major consideration in designing and locating low buildings. Most soils of coastal areas in the Southeastern Alaska, South Central Alaska Mountains, and Alaska Peninsula and Southwestern Islands Major Land Resource Areas are not seriously affected by frost action, but all soils except sands and very gravelly sands elsewhere in Alaska are subject to damage by frost action. Silty soils and organic soils are most strongly susceptible to frost heaving, even at depths ranging up to 10 feet (3 m) or more. Frost-susceptible soils with a perennially frozen substratum have especially severe limitations as building sites.

Organic soils, because of their wetness, low bearing strength, and in most of the State high susceptibility to frost action make poor building sites. Limitations are most severe where the thickness of the organic material over a mineral substratum is more than 50 inches (125 cm).

Figure 51.—Mudflow from thawing permafrost where organic surface layer was stripped for road construction. Near Birch Creek Bridge on Steese Highway.

Steep slopes increase the difficulty of construction, may lack stability, and in many places are highly erodible when the native vegetation is removed. Excessive stoniness and shallow bedrock increase building costs and interfere with the installation of underground utilities.

Ratings that follow are in terms of soil limitations for both construction and maintenance of the buildings:

Slight. The soil limitations, if any, are easily overcome and do not require unusual planning or design or alterations of natural soil features.

Moderate. Soil limitations need to be recognized but can be overcome by careful planning or design. A few special precautions or alterations may be needed.

Severe. The soil limitations are difficult to overcome. Special precautions or alterations are required which may not be economically feasible.

Very severe. The soil limitations are too severe to be overcome except at great cost. The soils are generally unsuitable for low buildings.

Recreation

Soil evaluations are for only the more intensive types of recreational uses such as campgrounds, picnic areas, golf courses (fig. 52), and playgrounds. Activities like hunting, hiking and mountain climbing, which require no site development, are not considered in the ratings. The ratings are based only on the soil features that affect the use and do not take into account esthetic values, climatic limitations, or accessibility.

The principal soil characteristics that affect ratings for recreational use are internal drainage, slope, consistence (firmness) under use, stoniness, susceptibility to flooding, and depth to bedrock. The best soils for areas subject to heavy foot traffic are well drained, level or nearly level, firm under continuous use and seldom excessively dusty or slippery, free of surface stones or boulders, never flooded, and deep enough over bedrock so that rock does not interfere with excavations or the erection of small structures.

Ratings that follow are in terms of severity of soil limitations for recreation:

Figure 52.—Fairbanks Golf Course.

Slight. Soil limitations, if any, are easily overcome.
Moderate. Soil limitations need to be recognized but can be overcome with careful planning and design. A few special practices and modifications, such as leveling or stone removal, may be necessary. Soils subject to only occasional flooding are considered to have a moderate limitation.
Severe. Soil limitations interfere seriously with intensive recreational use and are difficult to overcome. The necessary modifications may not be economically feasible.
Very severe. Soil limitations are too severe to be overcome. These soils are generally not suitable for development for recreational use.

Off-road trafficability

Off-road trafficability refers to cross-country movement of conventional wheeled and tracked vehicles, including construction equipment. Special low ground pressure vehicles designed for movement across unfavorable terrain were not considered. Also, no consideration was given to nonsoil factors, such as density of vegetation, occurrence of lakes or streams, or thickness of snow cover. Soil features of greatest importance in relation to offroad vehicular movement are duration of wet conditions; soil texture as it relates to ability to support loads, to traction, and to dustiness under traffic; slope; and erodibility of the soil.

Vehicular traffic is most severely limited on soils that remain wet throughout the summer. These include most soils underlain by solid ice-rich permafrost and organic soils and poorly drained mineral soils south of the permafrost zone. Vehicles bog down easily on wet soils, especially after repeated passes over the same point and destruction of the native vegetation. Organic soils are particularly poor in this respect.

Silty and clayey soils, even those that are well drained, become slippery after rains and are commonly very dusty when dry. These soils are highly erodible, and severe gullying can take place even on gentle or moderate slopes when the native vegetation

is removed. Sandy soils are less erodible, but afford poor traction when dry.

Soils with ice-rich permafrost at shallow depths are particularly vulnerable to damage under traffic. Depressions or ruts left by wheels or tracks result in increased depth of thaw and a concentration of surface water in the depressions. Running water over frozen slopes can easily create deep gullies that are impassable and almost impossible to control.

Soil limitation ratings, based on features of the undisturbed soils, are defined as follows:

Slight. Soil limitations, if any, do not restrict the movement of cross-country vehicles.

Moderate. Soil limitations need to be recognized but can generally be overcome with careful route planning. Some special equipment may be required.

Severe. Soil limitations are difficult to overcome, and special equipment and careful route planning are required. These soils should be avoided if possible.

Very severe. Soil limitations are generally too difficult to overcome. Generally these soils are unsuitable for conventional off-road vehicles.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or

prisms, are called peds. Clods are aggregates produced by tillage or logging.

Albic horizon. A mineral soil horizon from which clay and free iron oxides have been removed or in which the oxides have been segregated to the extent that the color of the horizon is determined primarily by the color of the primary sand and silt particles rather than by coatings on these particles.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Cambic horizon. A mineral soil horizon that has a texture of loamy very fine sand or finer, has soil structure rather than rock structure, contains some weatherable minerals, and is characterized by the alteration or removal of mineral material as indicated by mottling or gray colors, stronger chromas or redder hues than in underlying horizons, or the removal of carbonates. The cambic horizon lacks cementation or induration and has too few evidences of illuviation to meet the requirements of the argillic or spodic horizon.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Delta. An alluvial deposit, commonly triangular in shape, formed largely beneath water and deposited at the mouth of a river or stream.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. None means that flooding is not probable; rare that it is unlikely but possible under unusual weather conditions; occasional that it occurs on an average of once or less in 2 years; and frequent that it occurs on an average of more than once in 2 years. Duration is expressed as very brief if less than 2 days, brief if 2 to 7 days, and long if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by melt water as it flows from glacial ice.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes by water originating mainly from the melting of glacial ice. Many are interbedded or laminated.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy textured) soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Muck. Dark-colored, finely divided, well decomposed organic soil material mixed with mineral soil material. The content of organic matter is more than 20 percent.

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Outwash plain. A land form of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, hardpan, fragipan, claypan, plowpan, and traffic pan.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Permafrost. Layers of soil, or even bedrock, occuring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Placic horizon. A black to dark reddish mineral soil horizon that is usually thin but that may range from 1 mm to 25 mm in thickness. The placic horizon is commonly cemented with iron and is slowly permeable or impenetrable to water and roots.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is express as—

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: very coarse sand (2.0 millimeters to 1.0 millimeter); coarse sand (1.0 to 0.5 millimeter); medium sand (0.5 to 0.25 millimeter); fine sand (0.25 to 0.10 millimeter); very fine sand (0.10 to 0.05 millimeter); silt (0.05 to 0.002 millimeter); and clay (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in

which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Spodic horizon. A mineral soil horizon that is characterized by the illuvial accumulation of amorphous materials composed of aluminum and organic carbon with or without iron. The spodic horizon has a certain minimum thickness, and a minimum quantity of extractable carbon plus iron plus aluminum in relation to its content of clay.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans)

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Till plain. An extensive flat to undulating area underlain by glacial till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Umbric epipedon. A surface layer of mineral soil that has the same requirements as the mollic epipedon with respect to color, thickness, organic carbon content, consistence, structure, and P_2O_5 content, but that has a base saturation of less than 50% when measured at pH 7.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

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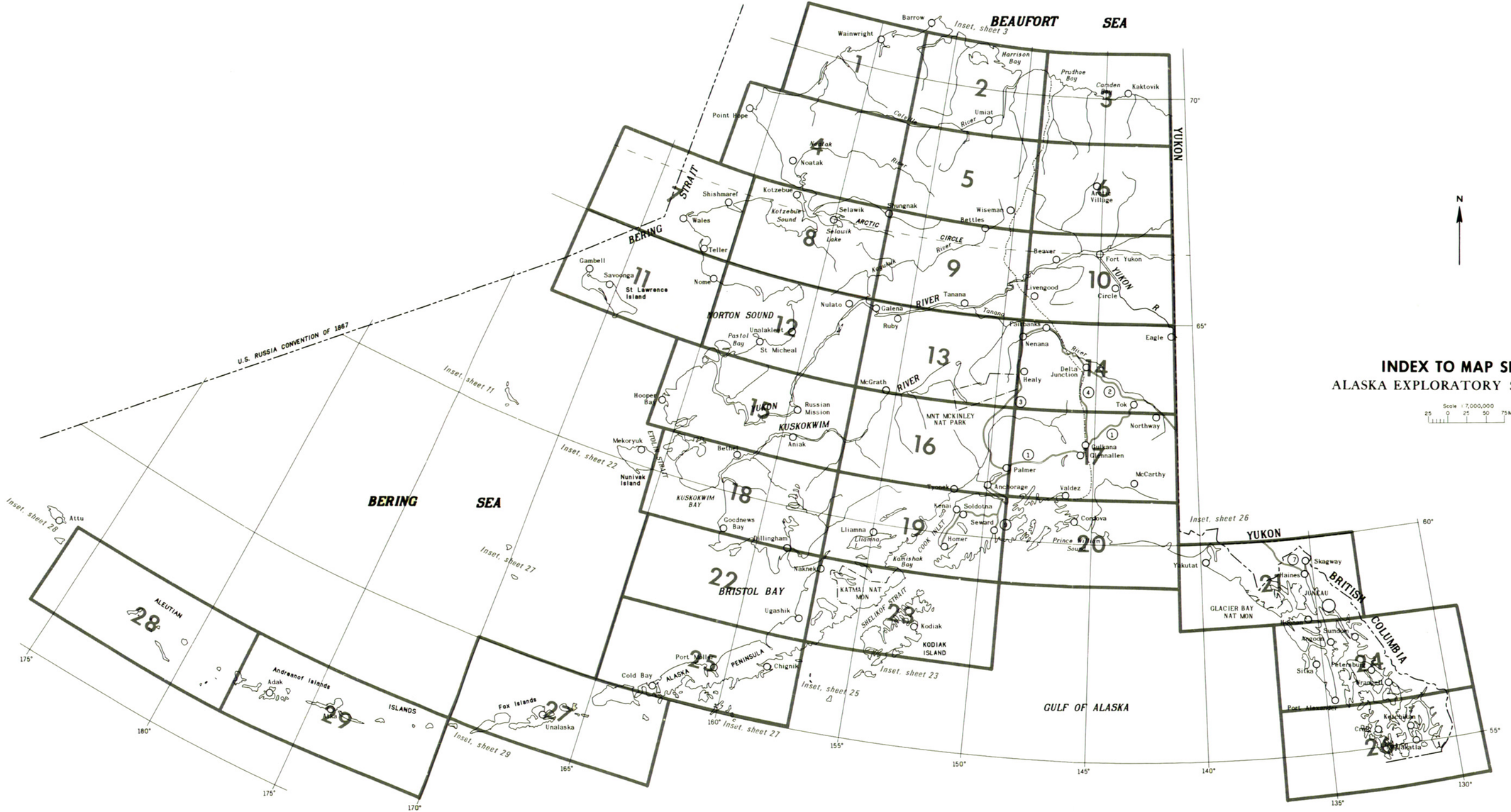
INDEX TO MAP SHEETS
ALASKA EXPLORATORY SOIL SURVEY
Scale 1:7,000,000
25 0 25 50 75 Miles
N
BEAUFORT SEA
BERING SEA
GULF OF ALASKA
BERING STRAIT
NORTON SOUND
BRISTOL BAY
KUSKOKWIM BAY
COOK INLET
SHELIKOF STRAIT
ALASKA PENINSULA
KODIAK ISLAND
ALEUTIAN ISLANDS
Andreanof Islands
Fox Islands
YUKON
KUSKOKWIM
ARCTIC
CIRCLE
YUKON R
BRITISH COLUMBIA
MNT MCKINLEY NAT PARK
GLACIER BAY NAT MON
KATMAI NAT MON
U.S. RUSSIA CONVENTION OF 1867
Barrow
Wainwright
Point Hope
Kotzebue
Shishmaref
Wales
Teller
Gambell
Savoonga
St Lawrence Island
Nome
Nulato
Galena
Ruby
Unalakleet
St Micheal
Noatak
Kotzebue Sound
Selawik
Selawik Lake
Shungnak
Kobuk
Wiseman
Bettles
Arctic Village
Beaver
Fort Yukon
Livengood
Circle
Tanana
Fairbanks
Nenana
Eagle
Delta Junction
Healy
McGrath
Tok
Northway
Hooper Bay
Russian Mission
Mekoryuk
Nunivak Island
Bethel
Aniak
Goodnews Bay
Dillingham
Nakneck
Ugashik
Kenai
Soldotna
Seward
Homer
Anchorage
Palmer
Valdez
Cordova
McCarthy
Kantishak Bay
Chignik
Cold Bay
Port Moller
Kodiak
Attu
Adak
Unalaska
Yakutat
Skagway
Haines
JUNEAU
Sumdum
Kake
Petersburg
Sitka
Wrangell
Port Alexander
Ketchikan
Prince Rupert
Inset, sheet 3
Inset, sheet 11
Inset, sheet 22
Inset, sheet 26
Inset, sheet 28
Inset, sheet 27
Inset, sheet 29
Inset, sheet 25
Inset, sheet 23
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
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145°
140°
135°
130°

LAND RESOURCE AREAS
ALASKA

JANUARY 1975

SCALE 1:6,750,000
1 INCH = APPROXIMATELY 100 MILES

LAND RESOURCE AREAS

Southern Alaska

168 Southeastern Alaska
169 South Central Alaska Mountains
170 Cook Inlet-Susitna Lowland
171 Alaska Peninsula and Southwestern Islands

Interior Alaska

172 Copper River Plateau
173 Alaska Range
174 Interior Alaska Lowlands
175 Kuskokwim Highlands
176 Interior Alaska Highlands

Arctic and Western Alaska

177 Norton Sound Highlands
178 Western Alaska Coastal Plains and Deltas
179 Bering Sea Islands
180 Brooks Range
181 Arctic Foothills
182 Arctic Coastal Plain

SOIL LEGEND

See introduction to descriptions of map units for explanation of connotative symbols.

SYMBOL	NAME
CL	Cinder land
DL	Dune land
EA1	Typic Cryaquents, loamy, nearly level - Terric Cryohemists, nearly level association
EA2	Typic Cryaquents, sandy, nearly level association
EA3	Typic Cryaquents, sandy, nearly level - Terric Sphagnofibrists, nearly level association
EA4	Typic Cryaquents - Typic Cryofluvents, very gravelly, nearly level association
EA5	Typic Cryaquents, very gravelly, hilly to steep - Rough mountainous land association
EF1	Typic Cryofluvents - Typic Cryaquents, loamy, nearly level association
EF2	Typic Cryofluvents - Histic Pergelic Cryaquepts, loamy, nearly level association
EO1	Typic Cryorthents, loamy, nearly level to rolling association
EO2	Typic Cryorthents, very gravelly, hilly to steep - Typic Cryohemists, nearly level to rolling association
EO3	Pergelic Cryorthents - Typic Cryochrepts, very gravelly, hilly to steep association
HY1	Sphagnic Borofibrists, nearly level association
HY2	Fluvaquentic Cryofibrists, nearly level association
HY3	Fluvaquentic Cryofibrists, nearly level - Typic Cryandepts, very gravelly, nearly level to rolling association
HY4	Pergelic Cryofibrists, nearly level association
HY5	Pergelic Cryofibrists, nearly level - Histic Pergelic Cryaquepts, sandy, nearly level to rolling association
IA1	Typic Cryandepts, loamy, hilly to steep association
IA2	Typic Cryandepts, loamy, hilly to steep - Rough mountainous land association
IA3	Typic Cryandepts, sandy, nearly level to rolling association
IA4	Typic Cryandepts - Histic Pergelic Cryaquepts, sandy, nearly level to rolling association
IA5	Typic Cryandepts, sandy, hilly to steep association
IA6	Typic Cryandepts, very gravelly, nearly level to rolling association
IA7	Typic Cryandepts, very gravelly, nearly level to rolling - Pergelic Cryofibrists, nearly level association
IA8	Typic Cryandepts - Pergelic Cryaquepts, very gravelly, nearly level to rolling association
IA9	Typic Cryandepts, very gravelly, hilly to steep association
IA10	Typic Cryandepts - Histic Pergelic Cryaquepts, very gravelly, hilly to steep association
IA11	Typic Cryandepts, very gravelly, hilly to steep - Rough mountainous land association
IA12	Dystric Cryandepts, loamy, nearly level to rolling - Fluvaquentic Cryofibrists, nearly level association
IA13	Dystric Cryandepts - Histic Pergelic Cryaquepts, loamy, nearly level to rolling association
IA14	Dystric Cryandepts, loamy, hilly to steep association
IA15	Dystric Cryandepts, loamy, hilly to steep, - Fluvaquentic Borohemists, nearly level association
IA16	Dystric Cryandepts, loamy, hilly to steep - Rough mountainous land association
IA17	Dystric Lithic Cryandepts, loamy, hilly to steep association
IQ1	Histic Pergelic Cryaquepts, clayey, nearly level to rolling association
IQ2	Histic Pergelic Cryaquepts, loamy, nearly level to rolling association
IQ3	Histic Pergelic Cryaquepts - Typic Cryofluvents, loamy, nearly level association
IQ4	Histic Pergelic Cryaquepts - Typic Cryorthents, loamy, nearly level to rolling association
IQ5	Histic Pergelic Cryaquepts, loamy, nearly level to rolling - Pergelic Cryorthents, very gravelly, hilly to steep association
IQ6	Histic Pergelic Cryaquepts, loamy, nearly level to rolling - Pergelic Cryofibrists, nearly level association
IQ7	Histic Pergelic Cryaquepts, loamy, nearly level to rolling - Pergelic Cryaquepts, very gravelly, nearly level to rolling association
IQ8	Histic Pergelic Cryaquepts, loamy, nearly level to rolling - Pergelic Cryaquepts, very gravelly, hilly to steep association
IQ9	Histic Pergelic Cryaquepts - Typic Cryochrepts, loamy, nearly level to rolling association
IQ10	Histic Pergelic Cryaquepts, loamy, nearly level to rolling - Typic Cryumbrepts, very gravelly, hilly to steep association
IQ11	Histic Pergelic Cryaquepts, loamy, nearly level to rolling - Pergelic Cryumbrepts, very gravelly, hilly to steep association
IQ12	Histic Pergelic Cryaquepts - Typic Cryorthods, loamy, nearly level to rolling association
IQ13	Histic Pergelic Cryaquepts - Typic Cryorthods, loamy, hilly to steep association
IQ14	Histic Pergelic Cryaquepts, loamy, nearly level to rolling - Typic Cryorthods, very gravelly, hilly to steep association
IQ15	Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling association
IQ16	Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling - Pergelic Cryoborolls, very gravelly, hilly to steep association
IQ17	Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling - Humic Cryorthods, very gravelly, hilly to steep association
IQ18	Histic Pergelic Cryaquepts - Typic Cryochrepts, very gravelly, hilly to steep association
IQ19	Histic Pergelic Cryaquepts - Typic Cryorthods, very gravelly, hilly to steep association
IQ20	Pergelic Cryaquepts - Pergelic Ruptic-Histic Cryaquepts, loamy, nearly level to rolling association
IQ21	Pergelic Cryaquepts - Pergelic Cryopsamments, sandy, nearly level to rolling association
IQ22	Pergelic Cryaquepts, very gravelly, nearly level association
IQ23	Pergelic Cryaquepts, very gravelly, nearly level to rolling - Pergelic Cryorthods, very gravelly, hilly to steep association
IQ24	Pergelic Cryaquepts - Pergelic Cryorthents, very gravelly, hilly to steep association
IQ25	Pergelic Cryaquepts - Pergelic Cryochrepts, very gravelly, hilly to steep association
IQ26	Pergelic Cryaquepts - Pergelic Cryorthods, very gravelly, hilly to steep association
IR1	Typic Cryochrepts, loamy, nearly level to rolling association
IR2	Typic Cryochrepts - Typic Cryorthents, loamy, nearly level to rolling association
IR3	Typic Cryochrepts, loamy, nearly level to rolling - Typic Cryopsamments, sandy, hilly to steep association
IR4	Typic Cryochrepts - Histic Pergelic Cryaquepts, loamy, nearly level to rolling association
IR5	Typic Cryochrepts - Entic Cryumbrepts, loamy, nearly level to rolling association
IR6	Typic Cryochrepts, loamy, hilly to steep - Histic Pergelic Cryaquepts, loamy, nearly level to rolling association
IR7	Typic Cryochrepts - Histic Pergelic Cryaquepts, sandy, nearly level to rolling association
IR8	Typic Cryochrepts, very gravelly, nearly level to rolling association
IR9	Typic Cryochrepts - Typic Cryorthents, very gravelly, nearly level to rolling association
IR10	Typic Cryochrepts, very gravelly, nearly level to rolling - Aeric Cryaquepts, loamy, nearly level to rolling association
IR11	Typic Cryochrepts, very gravelly, hilly to steep association
IR12	Typic Cryochrepts, very gravelly, hilly to steep - Histic Pergelic Cryaquepts, loamy, nearly level to rolling association
IR13	Typic Cryochrepts - Histic Pergelic Cryaquepts, very gravelly, hilly to steep association
IR14	Alfic Cryochrepts, loamy, hilly to steep - Histic Pergelic Cryaquepts, loamy, nearly level to rolling association
IU1	Pergelic Cryumbrepts, very gravelly, nearly level to rolling - Histic Pergelic Cryaquepts, loamy, nearly level to rolling association
IU2	Pergelic Cryumbrepts - Histic Pergelic Cryaquepts, very gravelly, hilly to steep association
IU3	Pergelic Cryumbrepts, very gravelly, hilly to steep - Rough mountainous land association
LF	Lava flows
MA1	Pergelic Cryaquolls - Histic Pergelic Cryaquepts, loamy, nearly level to rolling association
MA2	Pergelic Cryaquolls, very gravelly, nearly level to rolling association
MA3	Pergelic Cryaquolls, very gravelly, nearly level to rolling - Pergelic Cryoborolls, very gravelly, hilly to steep association
MB1	Typic Cryoborolls, loamy, nearly level to rolling association
MB2	Pergelic Cryoborolls - Pergelic Cryaquolls, very gravelly, hilly to steep association
RM1	Rough mountainous land
RM2	Rough mountainous land - Lithic Cryorthents, very gravelly, hilly to steep association
SH1	Typic Cryohumods, loamy, hilly to steep - Humic Cryorthods, very gravelly, hilly to steep association
SO1	Typic Cryorthods, loamy, nearly level to rolling - Sphagnic Borofibrists, nearly level association
SO2	Typic Cryorthods, loamy, hilly to steep - Sphagnic Borofibrists, nearly level association
SO3	Typic Cryorthods, sandy, nearly level to rolling - Histic Pergelic Cryaquepts, loamy nearly level to rolling association
SO4	Typic Cryorthods, very gravelly, nearly level to rolling - Sphagnic Borofibrists, nearly level association
SO5	Typic Cryorthods, very gravelly, hilly to steep - Sphagnic Borofibrists, nearly level association
SO6	Typic Cryorthods - Lithic Cryumbrepts, very gravelly, hilly to steep association
SO7	Humic Cryorthods, loamy, nearly level to rolling - Pergelic Cryofibrists, nearly level association
SO8	Humic Cryorthods, loamy, hilly to steep association
SO9	Humic Cryorthods, loamy, hilly to steep - Sphagnic Borofibrists, nearly level to rolling association
SO10	Humic Cryorthods, very gravelly, hilly to steep association
SO11	Humic Cryorthods, very gravelly, hilly to steep - Pergelic Cryofibrists, nearly level association
SO12	Humic Cryorthods, very gravelly, hilly to steep - Terric Cryohemists, nearly level to steep association
SO13	Humic Cryorthods, very gravelly, hilly to steep - Rough mountainous land association
SO14	Pergelic Cryorthods - Pergelic Cryaquepts, sandy, nearly level to rolling association
SO15	Pergelic Cryorthods - Histic Pergelic Cryaquepts, very gravelly, nearly level to rolling association
SO16	Pergelic Cryorthods, very gravelly, hilly to steep - Histic Pergelic Cryaquepts, loamy, nearly level to rolling association
SO17	Pergelic Cryorthods, very gravelly, hilly to steep - Rough mountainous land association
SO18	Humic Lithic Cryorthods - Humic Cryorthods, very gravelly, hilly to steep association

MAJOR LAND RESOURCE AREAS

SOUTHERN ALASKA

168 Southeastern Alaska
169 Southcentral Alaska Mountains
170 Cook Inlet-Susitna Lowland
171 Alaska Peninsula and Southwestern Islands

INTERIOR ALASKA

172 Copper River Platea
173 Alaska Range
174 Interior Alaska Lowlands
- A. Koyukuk-Innoko Lowland
- B. Kanuti Flats
- C. Tanana-Kuskokwim Lowland
- D. Yukon Flats

175 Kuskokwim Highlands
176 Interior Alaska Highlands

ARCTIC AND WESTERN ALASKA

177 Norton Sound Highlands
178 Western Alaska Coastal Plains and Deltas
- A. Selawik-Kobuk Delta
- B. Yukon-Kuskokwim Delta
- C. Bristol Bay Coastal Plain

179 Bering Sea Islands
180 Brooks Range
181 Arctic Foothills
182 Arctic Coastal Plain

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Roads and Trails
- Roads
- Trails

Railroads
- Single track

Towns
Buildings
Mine or quarry
Power line
Tanks
Well, oil, gas or test
Critical elevation
Approximate elevation

BOUNDARIES

National or state
International date line

DRAINAGE

Streams, double-line
- Perennial

Streams, single-line
- Perennial

Lakes and ponds
- Perennial

Marsh or swamp
Rapids

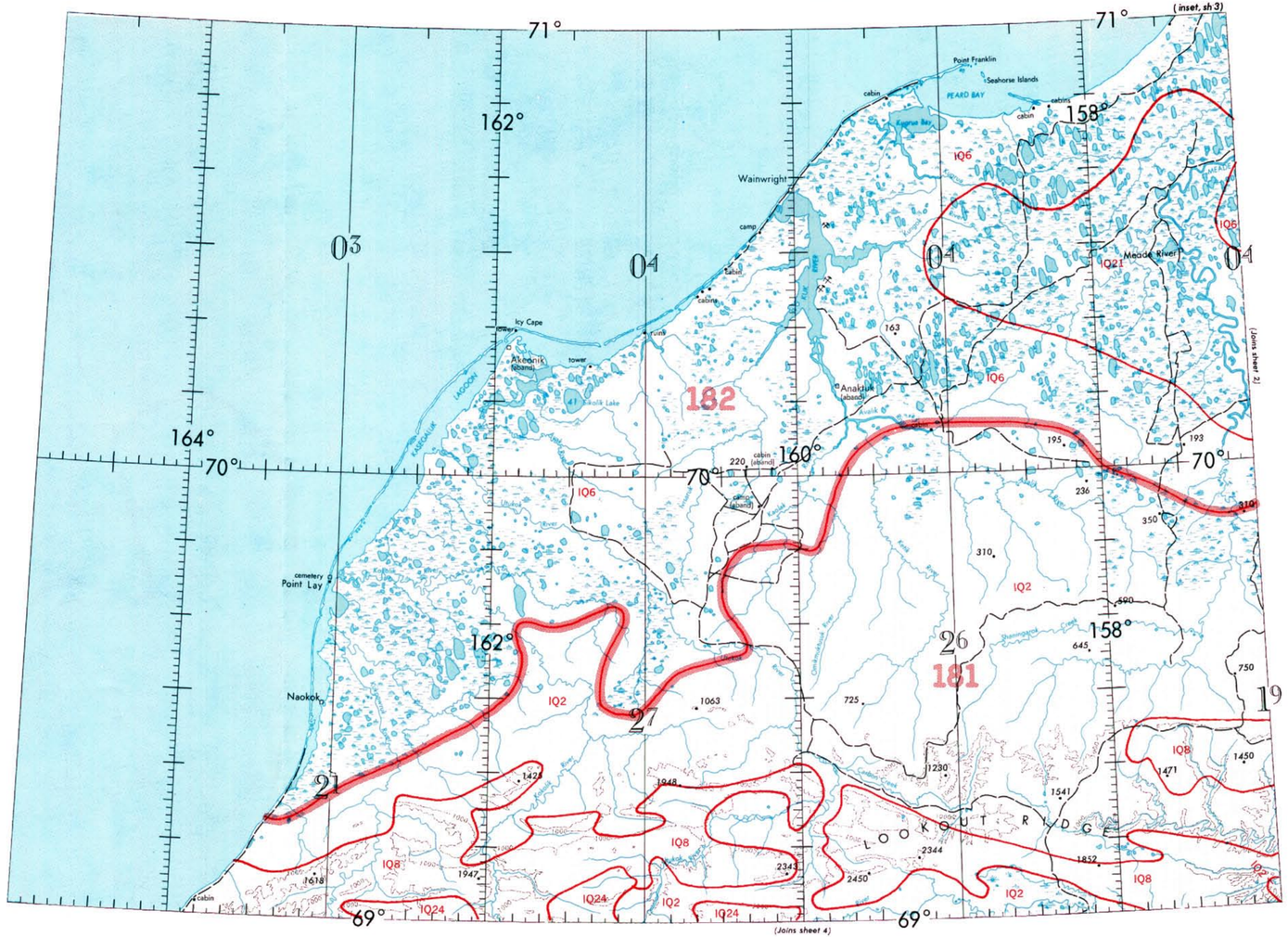
RELIEF

Glacier (Glacier)
Inundation area
Rock
Lava

SOIL SURVEY DATA

Soil boundary and symbol (IQ2)
Resource boundary and symbol (172)

ALASKA EXPLORATORY SOIL SURVEY — SHEET NUMBER 1



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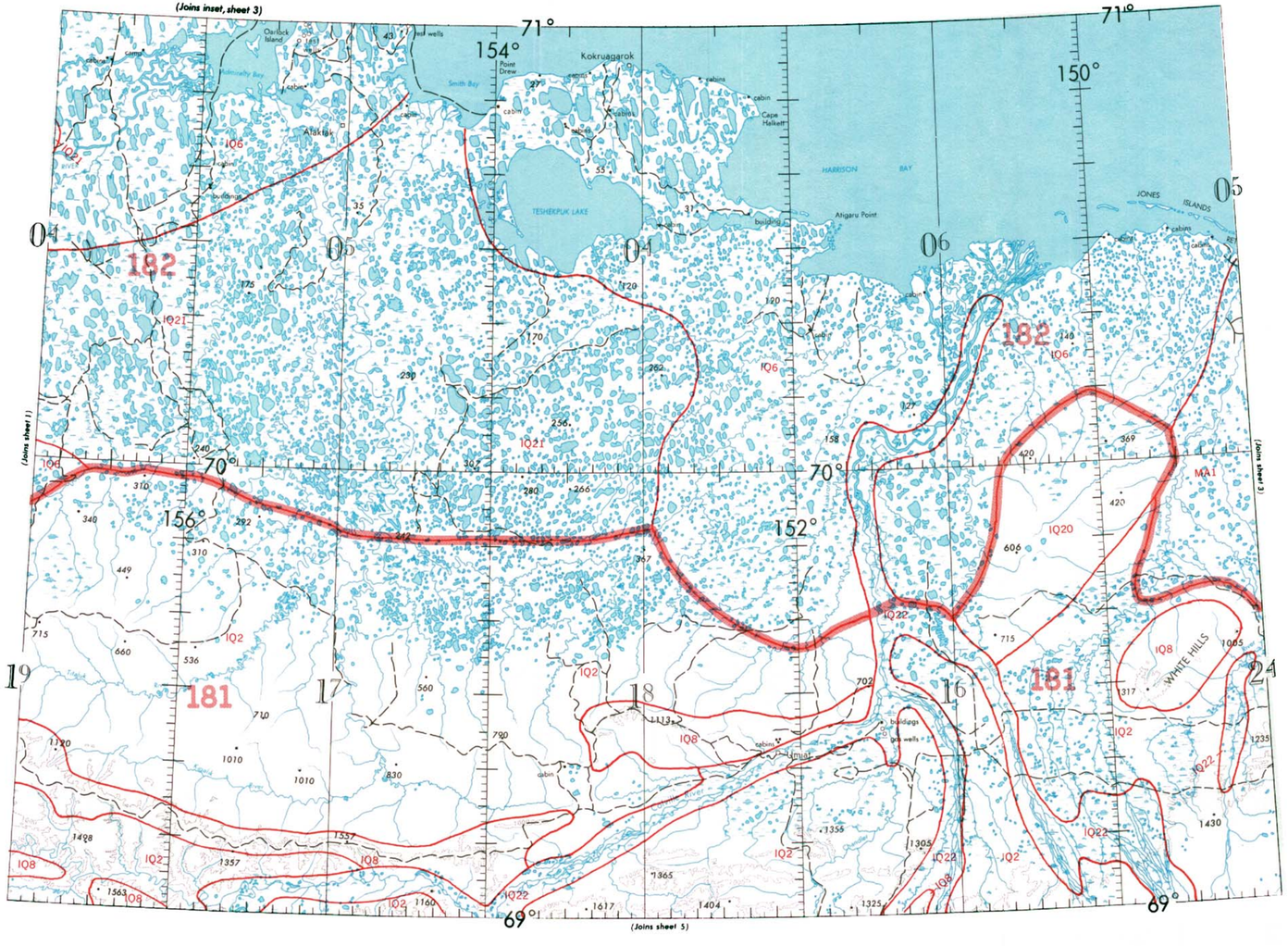

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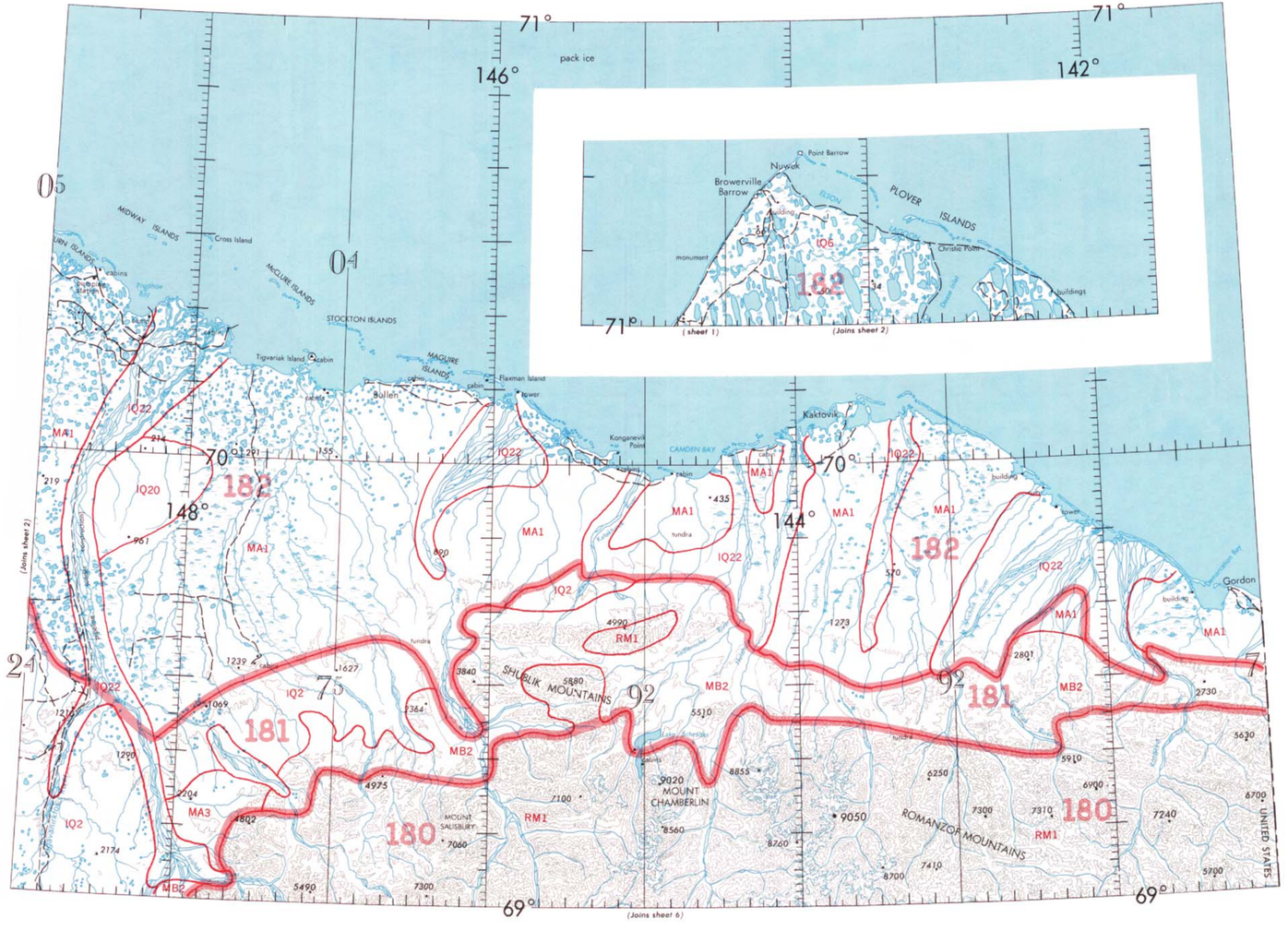

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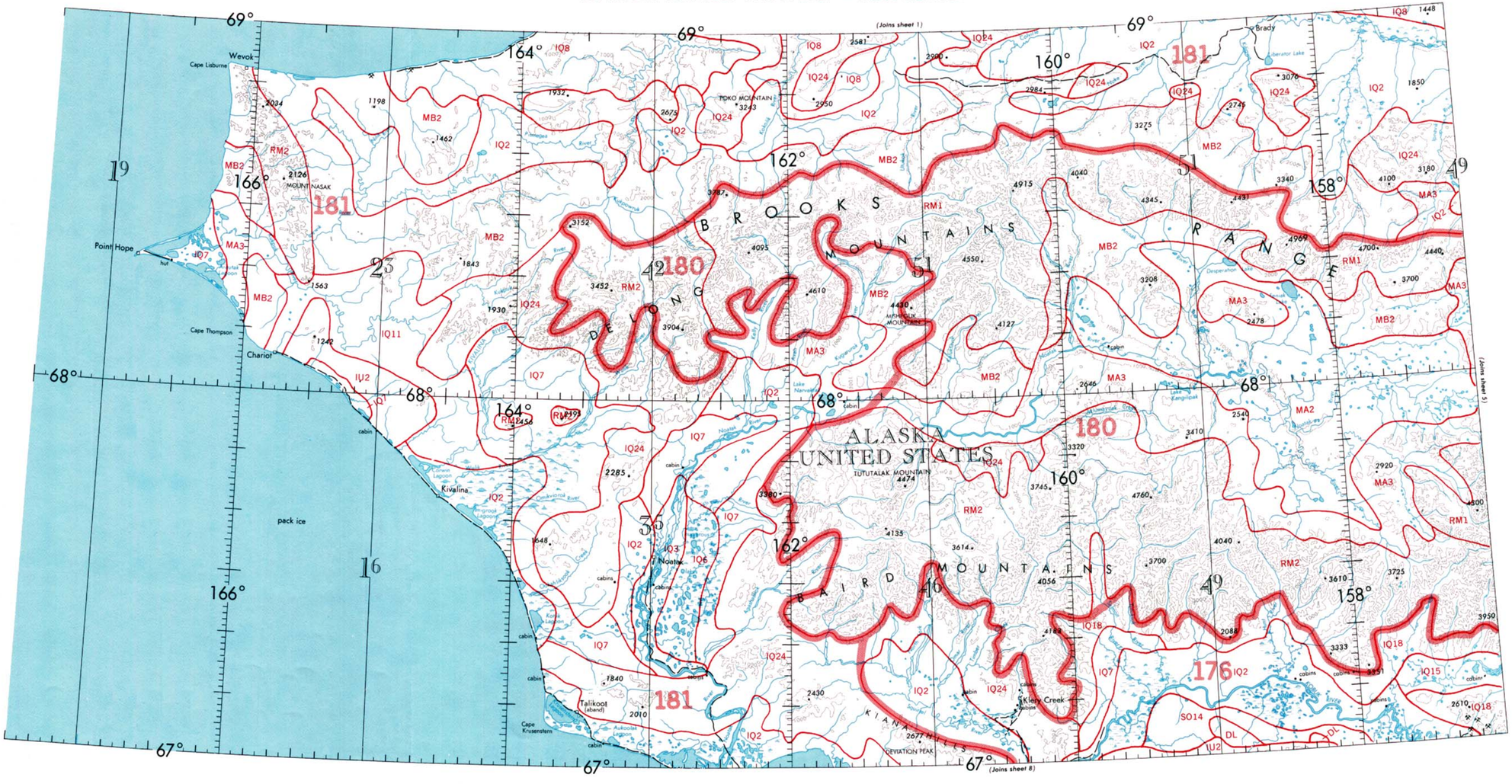
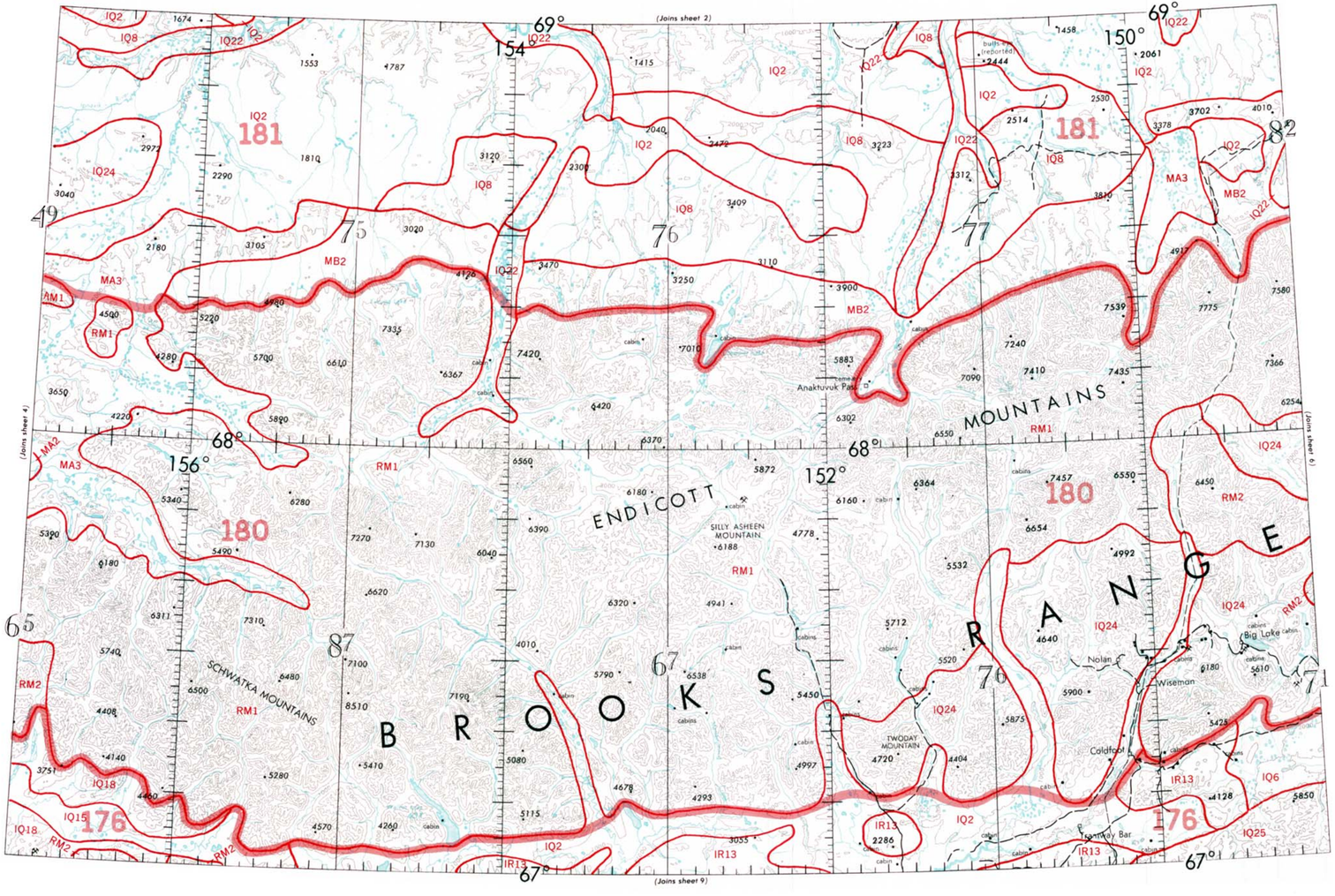


Base compiled 1970 by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, Soil Survey compiled 1971 by the U.S. Department of Agriculture, Soil Conservation Service, not copyrighted agencies.

ALASKA EXPLORATORY SOIL SURVEY — SHEET NUMBER 5



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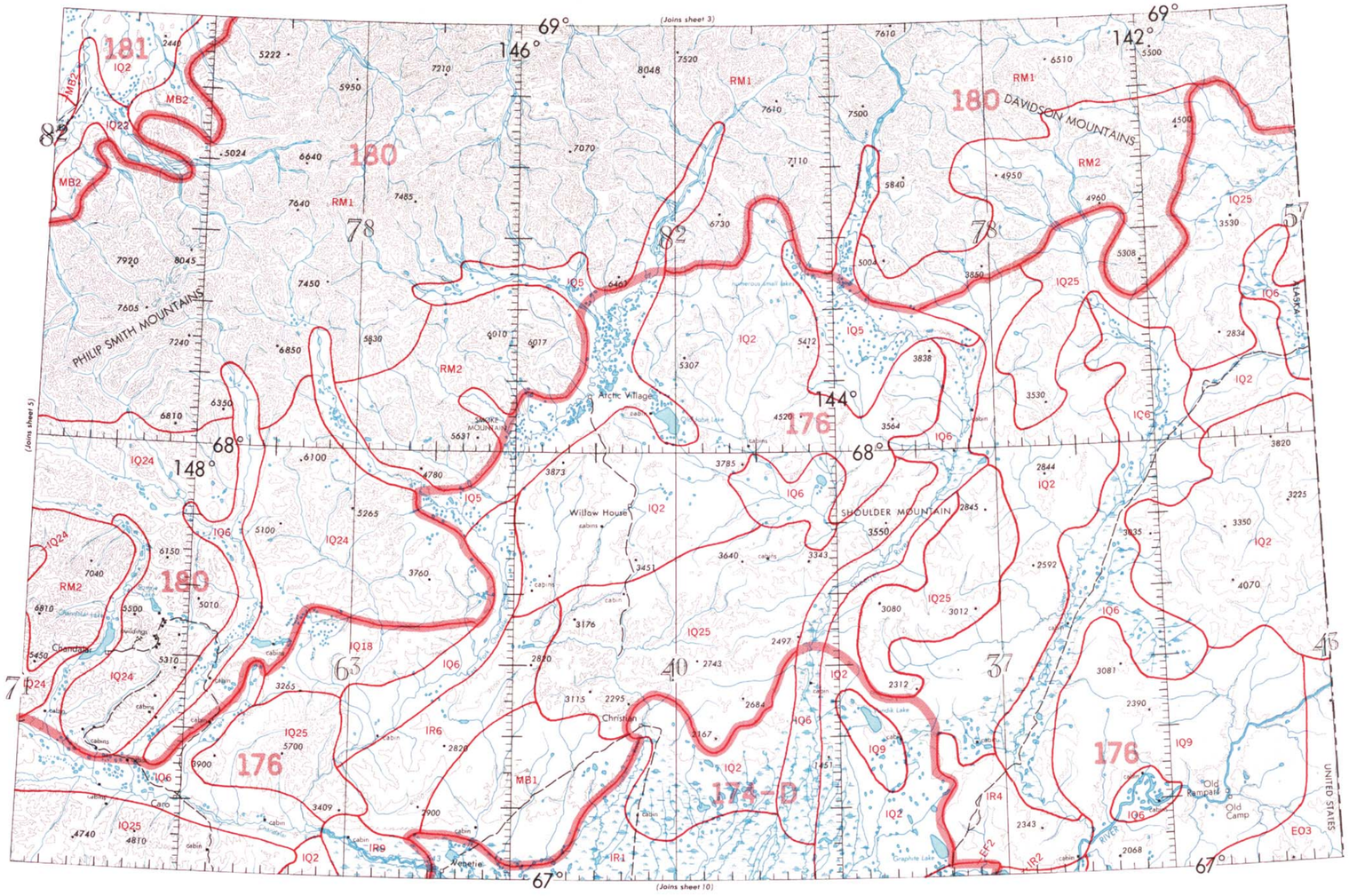
10 0 10 20 30 40 50 100 150 Kilometers

N

5

Base compiled 1970 by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey.
Soil Survey compiled 1971 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

ALASKA EXPLORATORY SOIL SURVEY — SHEET NUMBER 6



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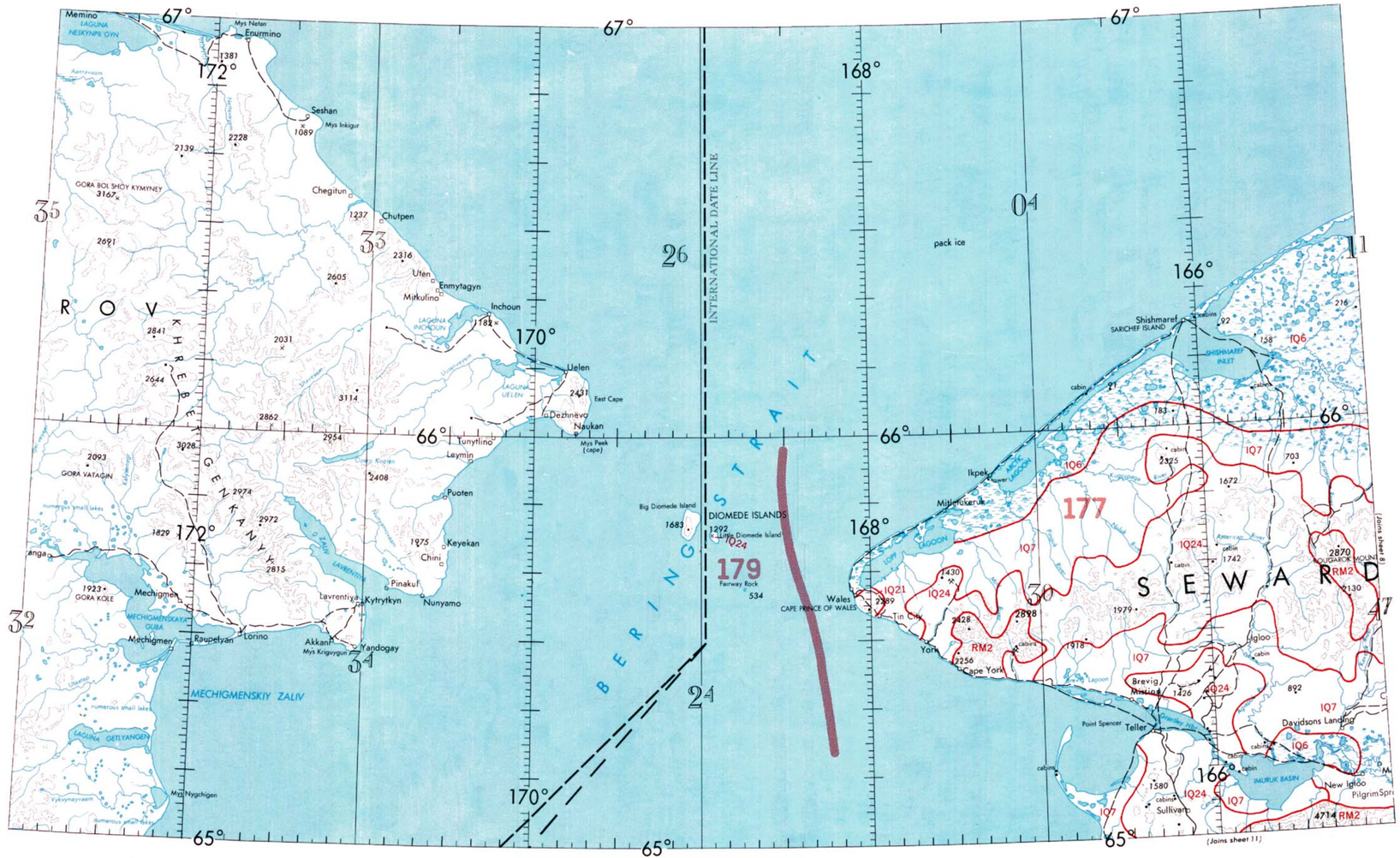
10 0 10 20 30 40 50 100 150 Kilometers

Base compiled 1972 by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey.
Soil Survey compiled 1971 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

ALAKSA EXPLORATORY SOIL SURVEY — SHEET NUMBER 7



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Base compiled 1970 by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey.
Soil survey compiled 1971 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

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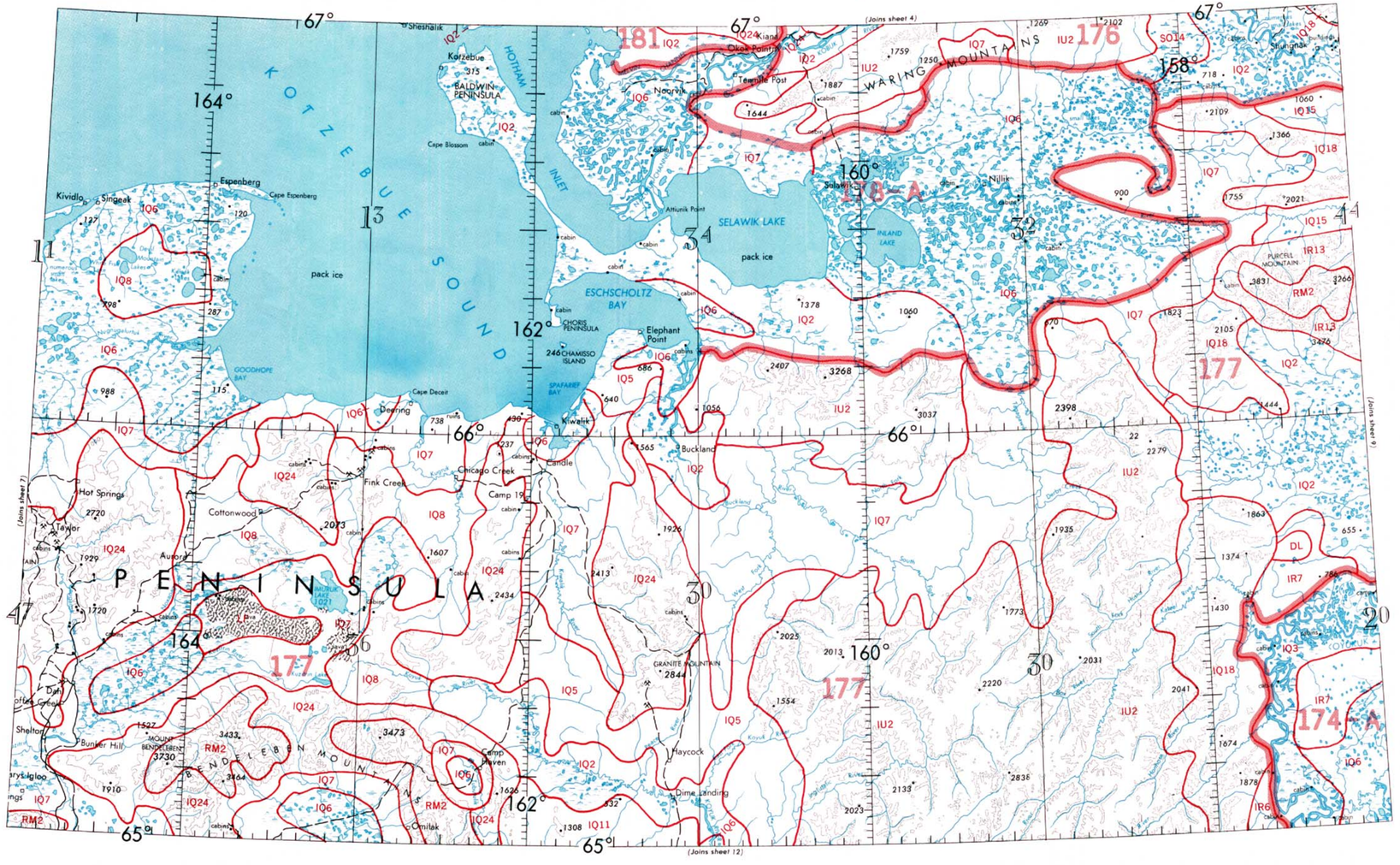
ALASKA EXPLORATORY SOIL SURVEY — SHEET NUMBER 8



Scale 1:1 000 000

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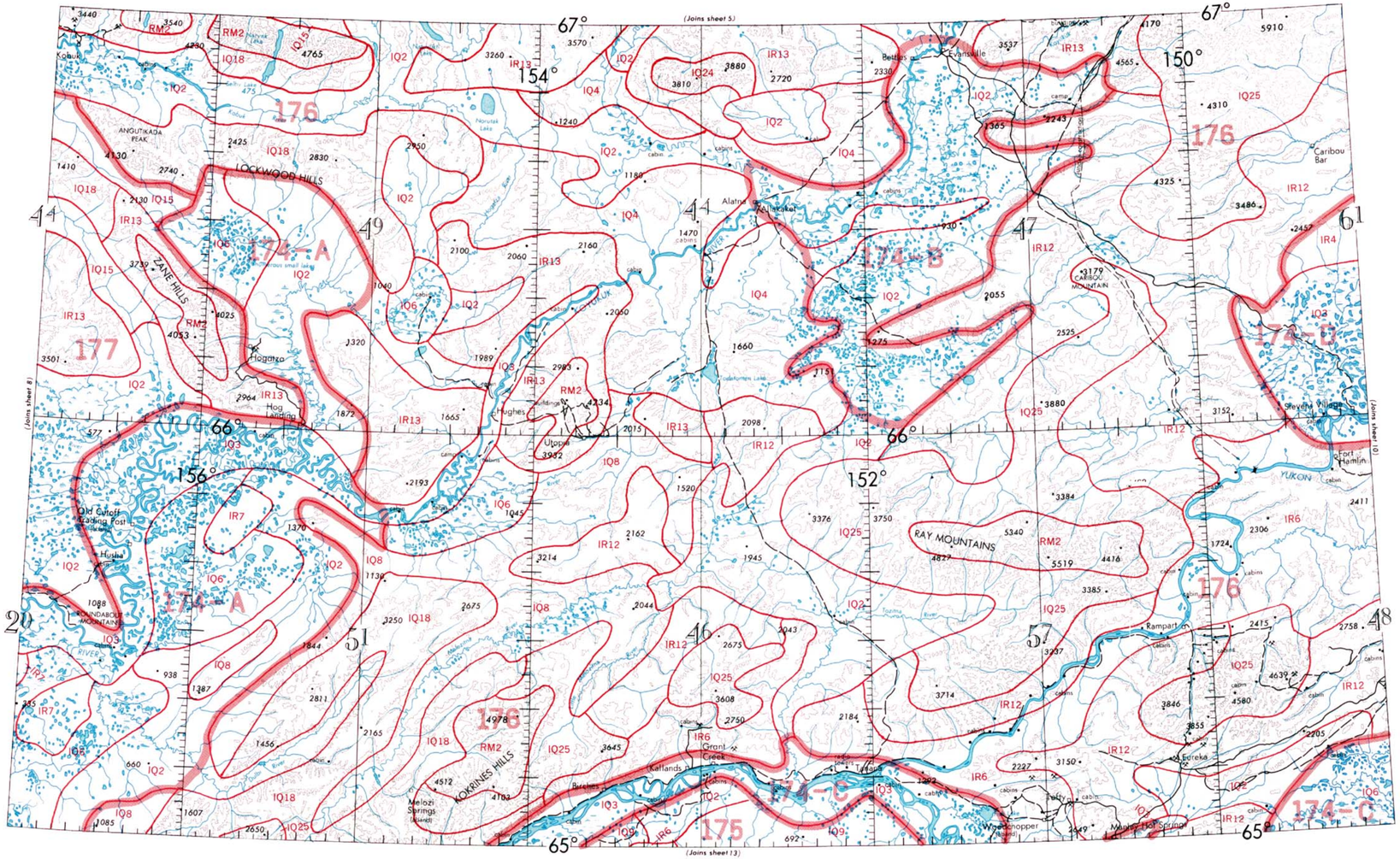
Base compiled 1970 by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey.
Soil Survey compiled 1971 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

ALASKA EXPLORATORY SOIL SURVEY — SHEET NUMBER 9



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Base compiled 1979 by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey.
Soil Survey compiled 1981 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

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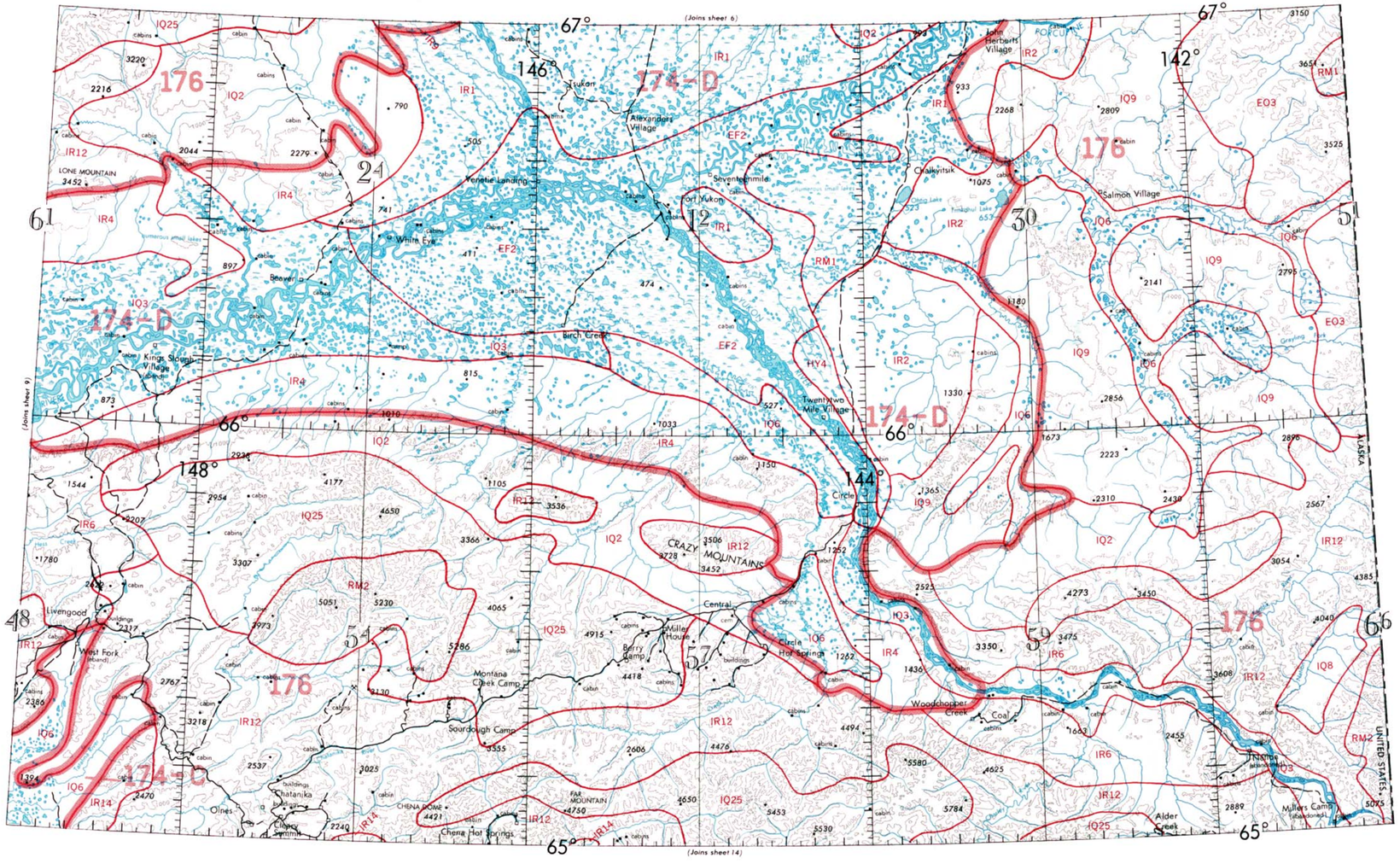

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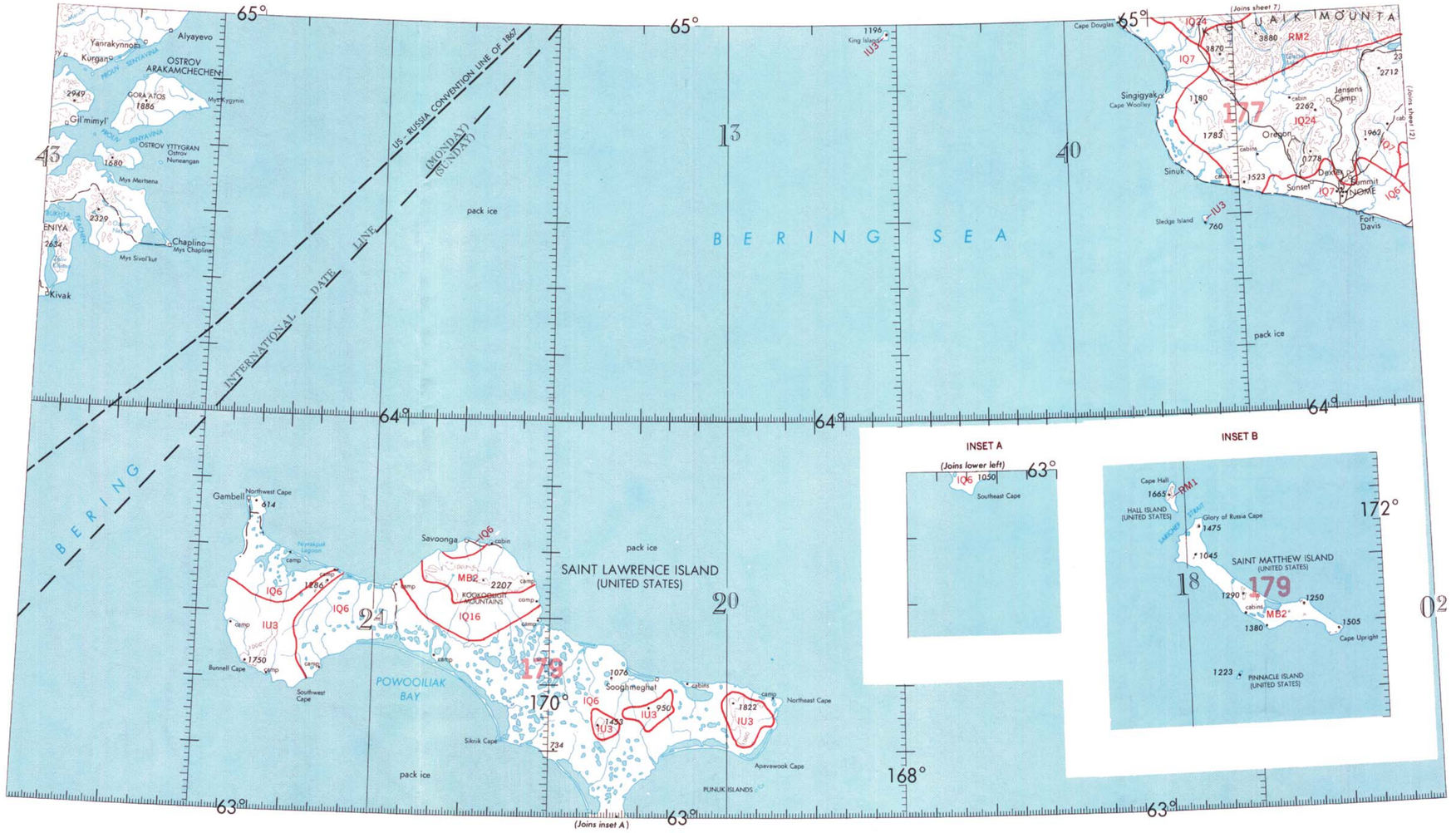

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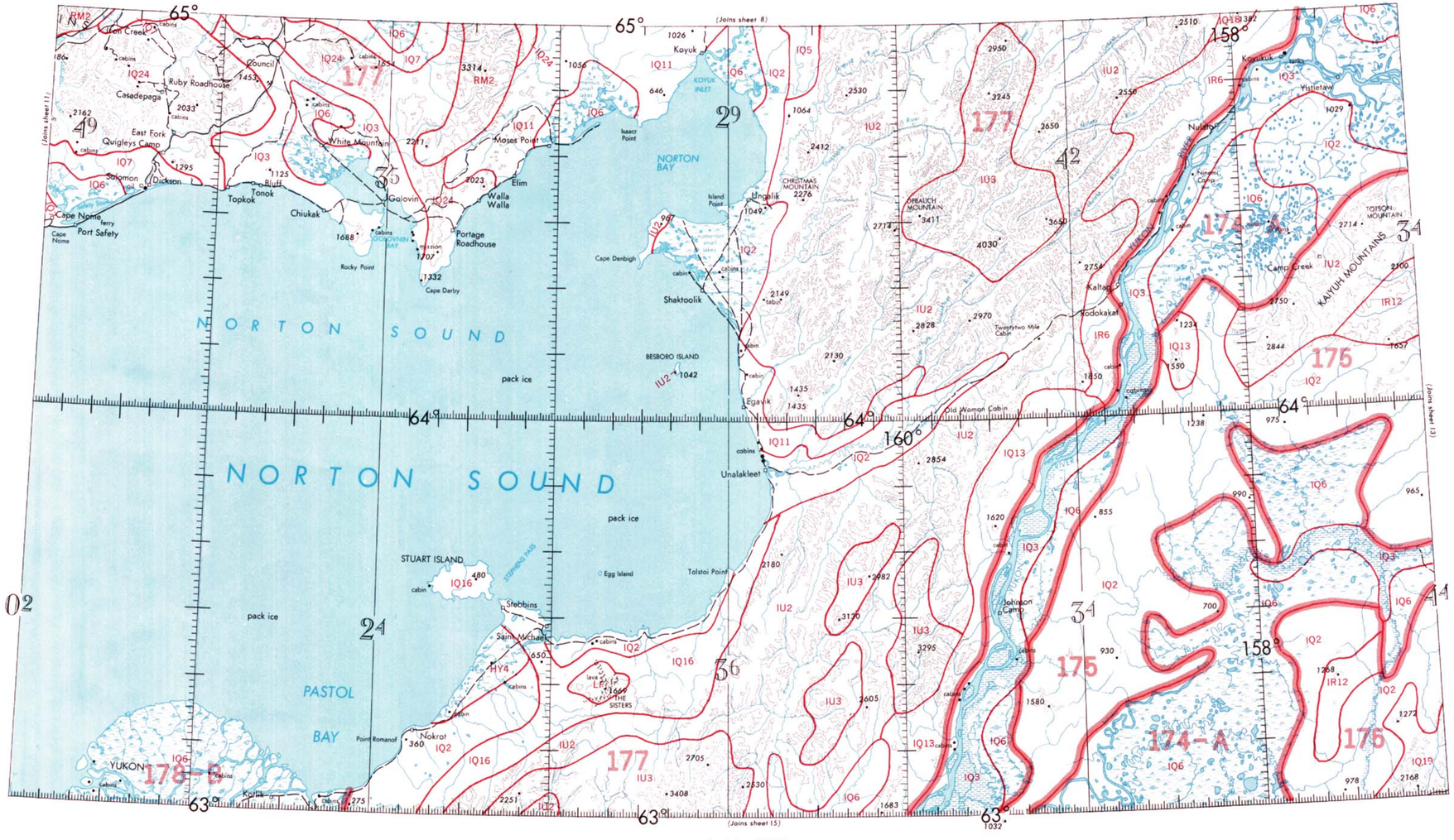

Base compiled 1970 by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey; Soil Survey compiled 1971 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

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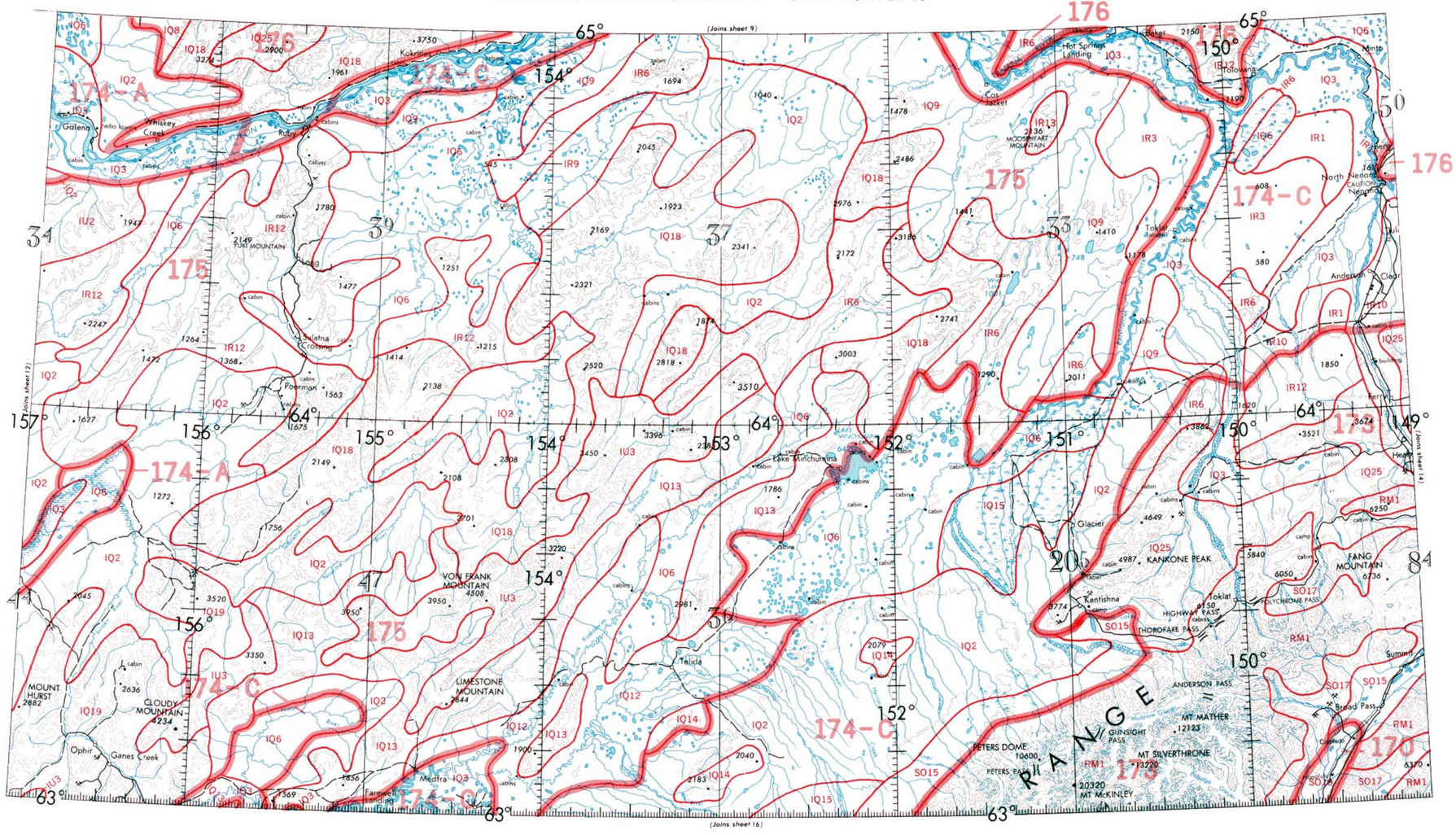

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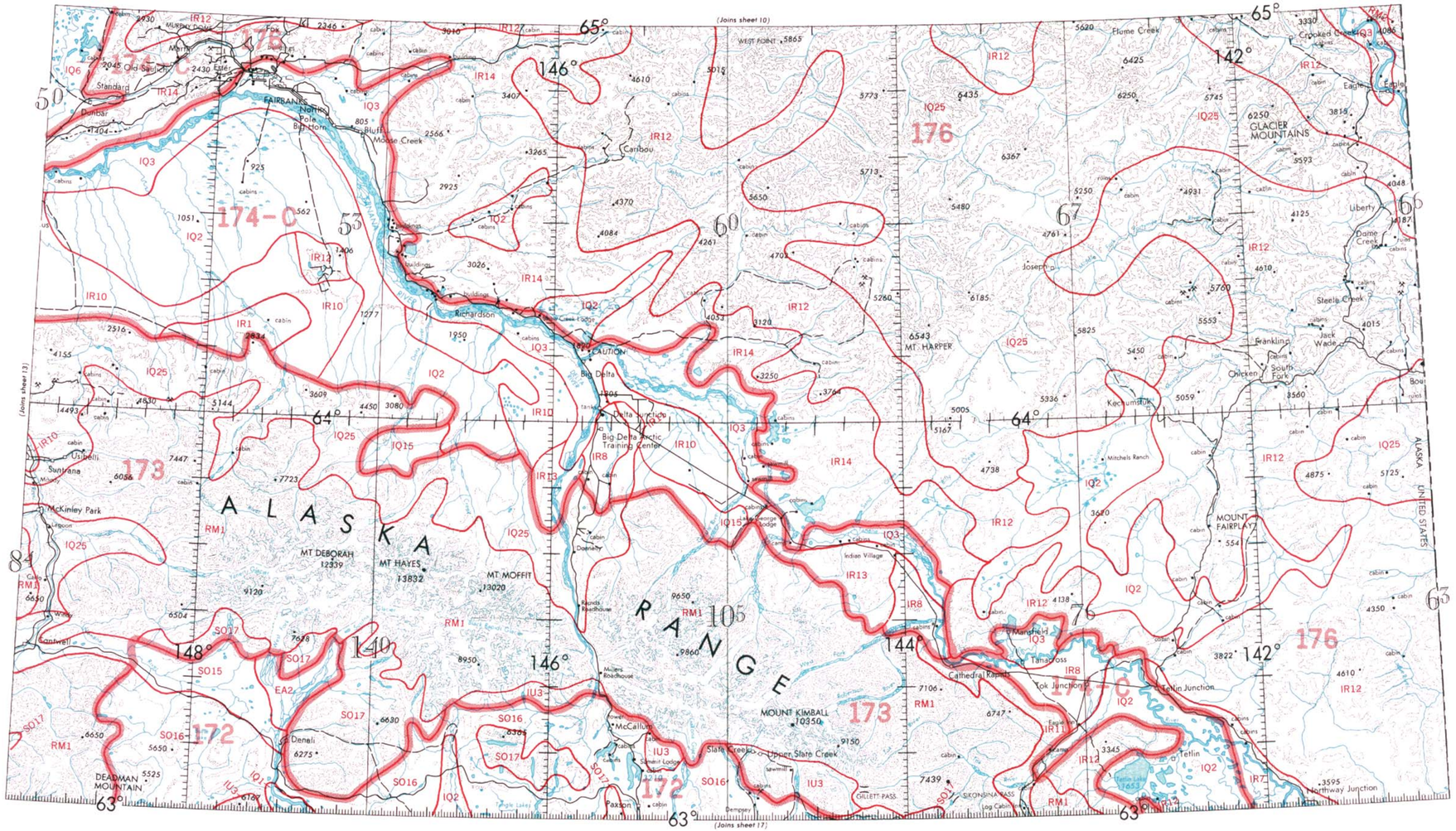

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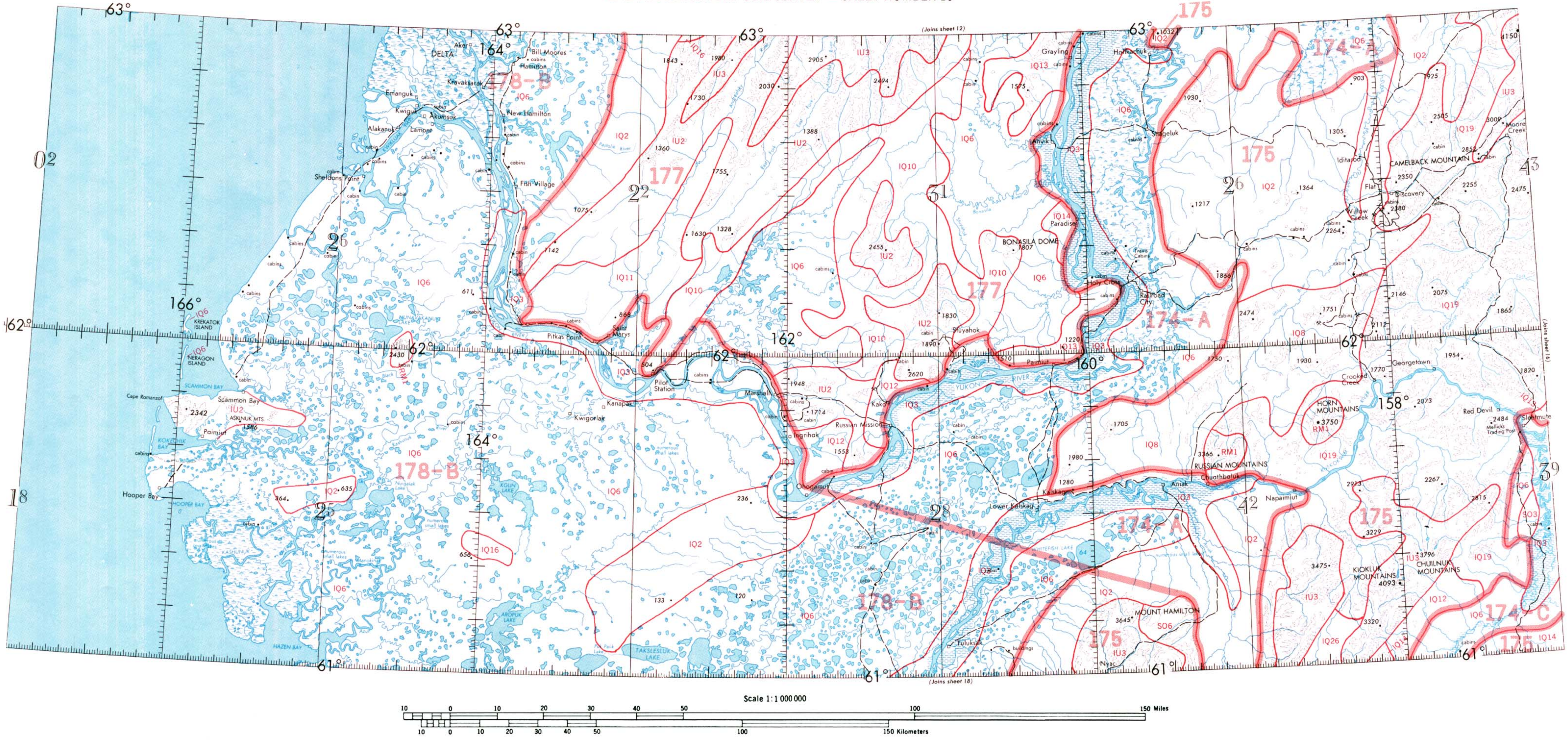
Base compiled 1970 by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey.
Soil Survey completed 1971 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

ALASKA EXPLORATORY SOIL SURVEY — SHEET NUMBER 15



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Base compiled 1970 by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey.
Soil Survey compiled 1971 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

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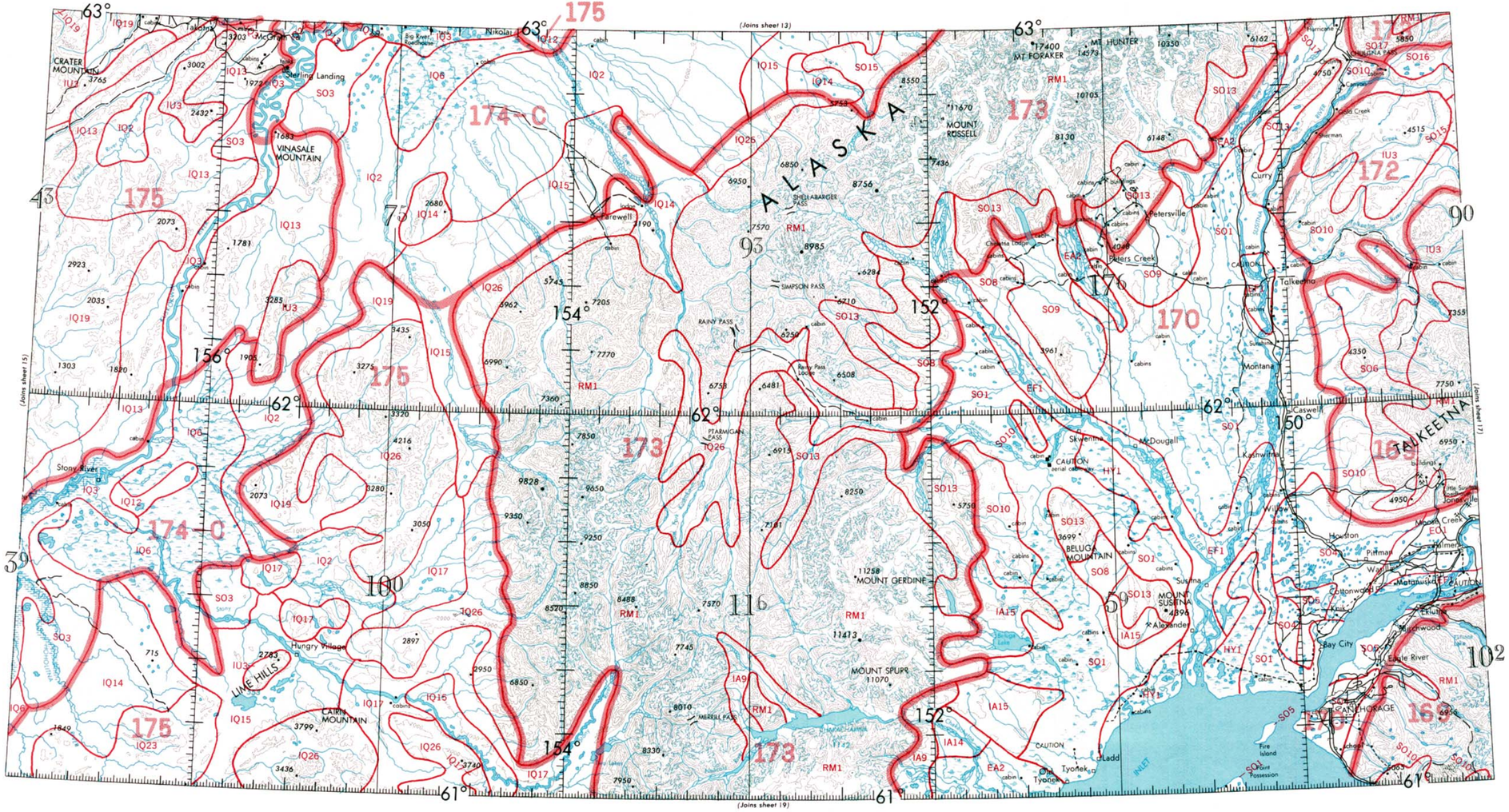
ALASKA EXPLORATORY SOIL SURVEY — SHEET NUMBER 16



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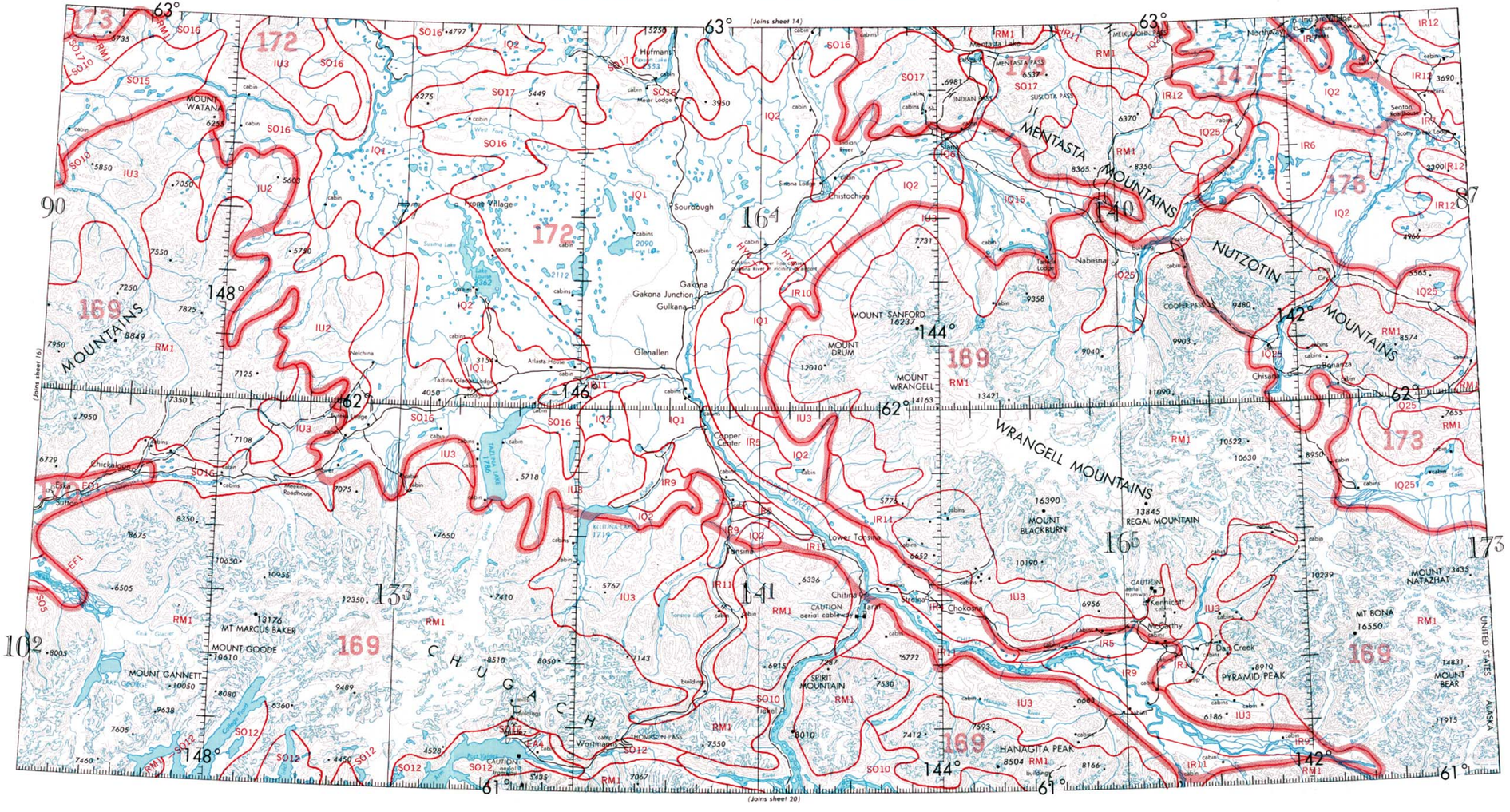

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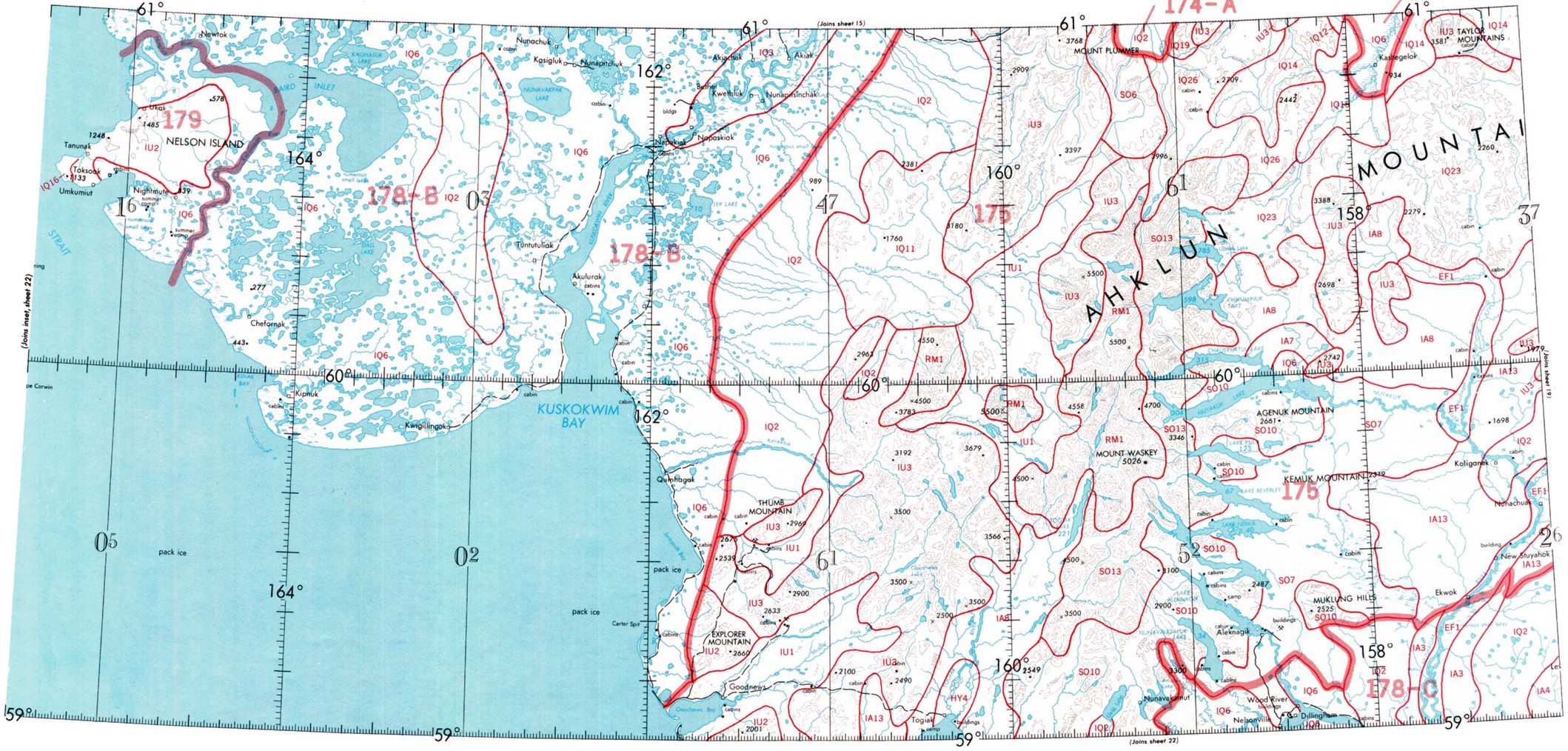

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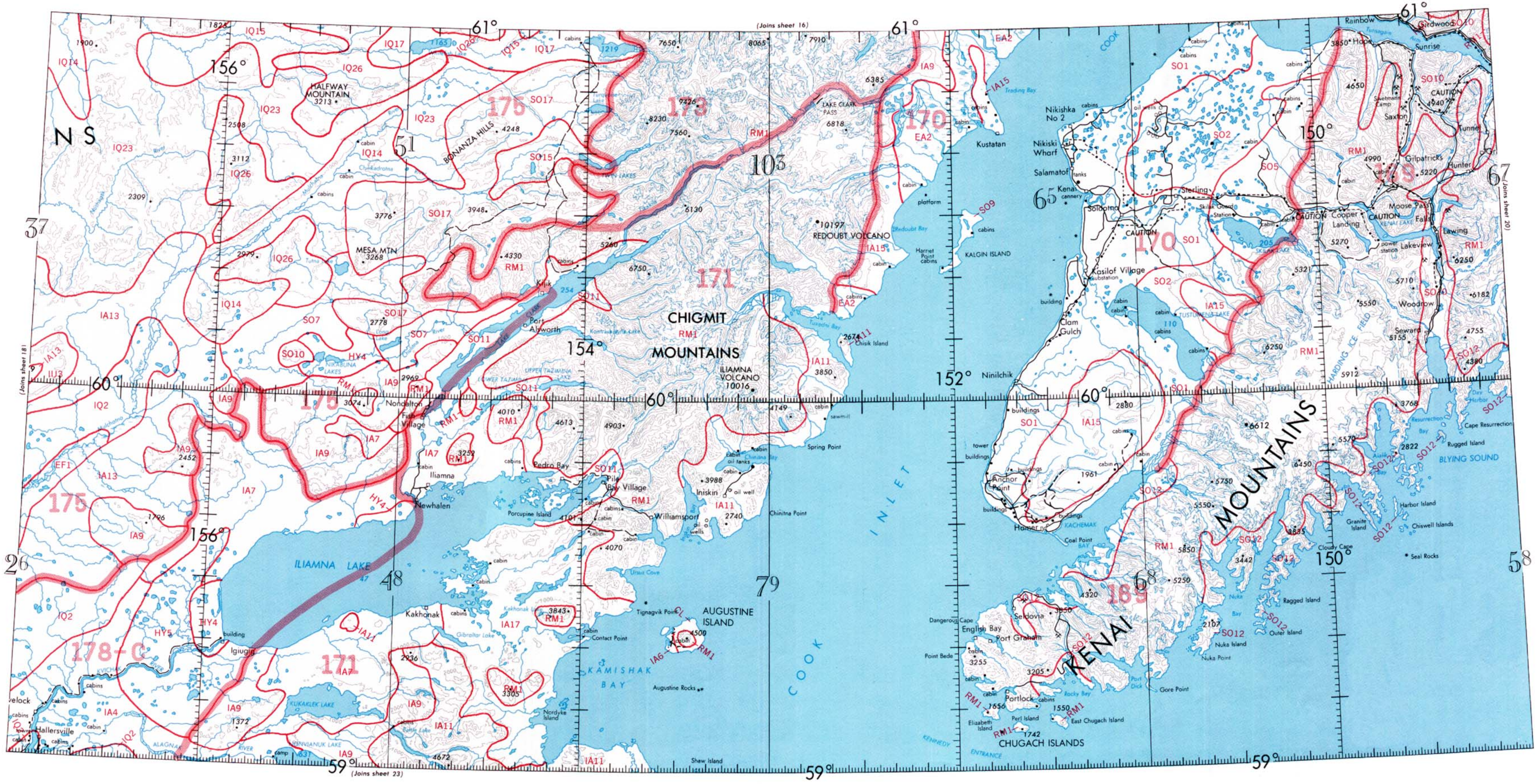

Scale 1:1 000 000

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Base compiled 1970 by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey. Soil Survey compiled 1971 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

20

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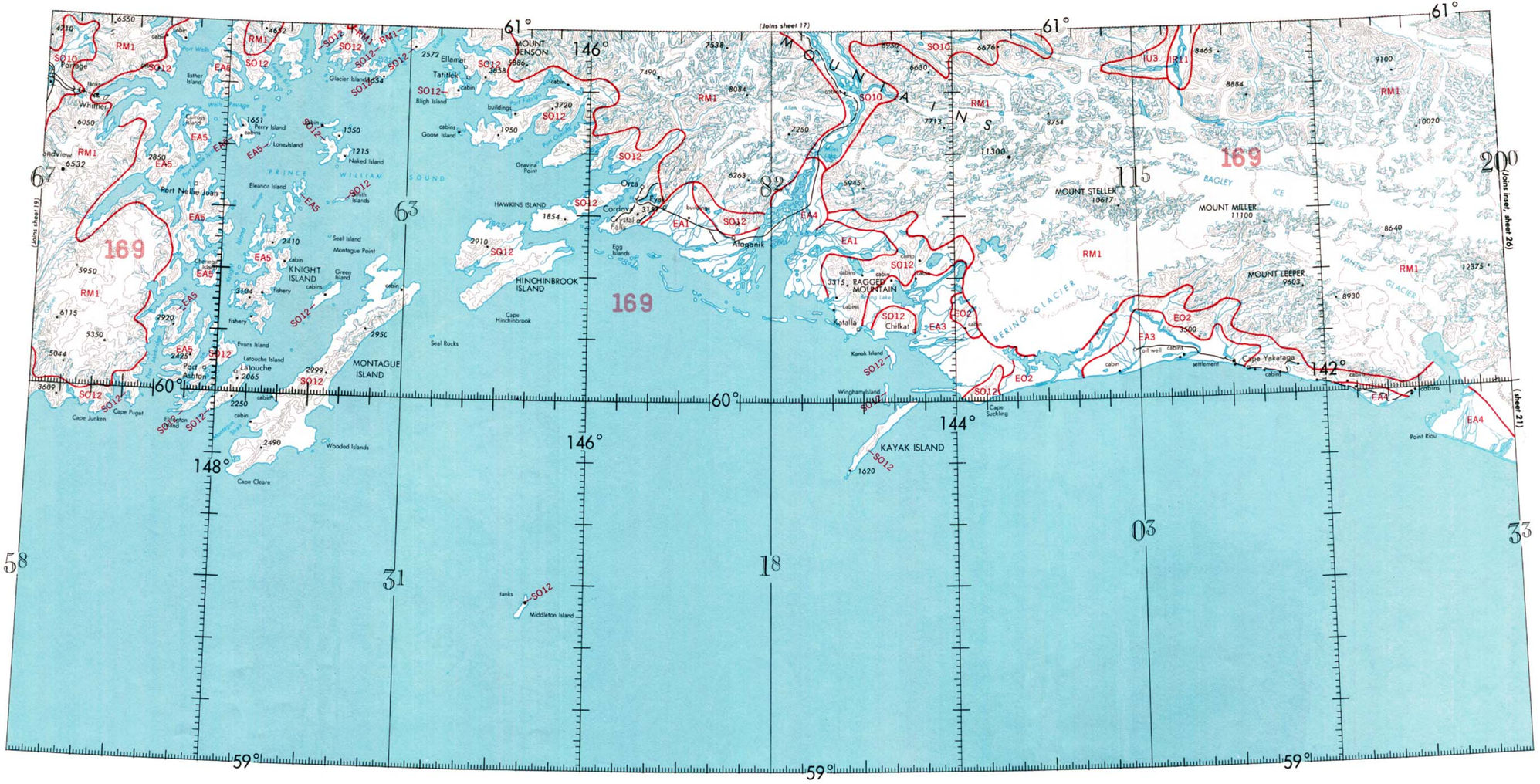
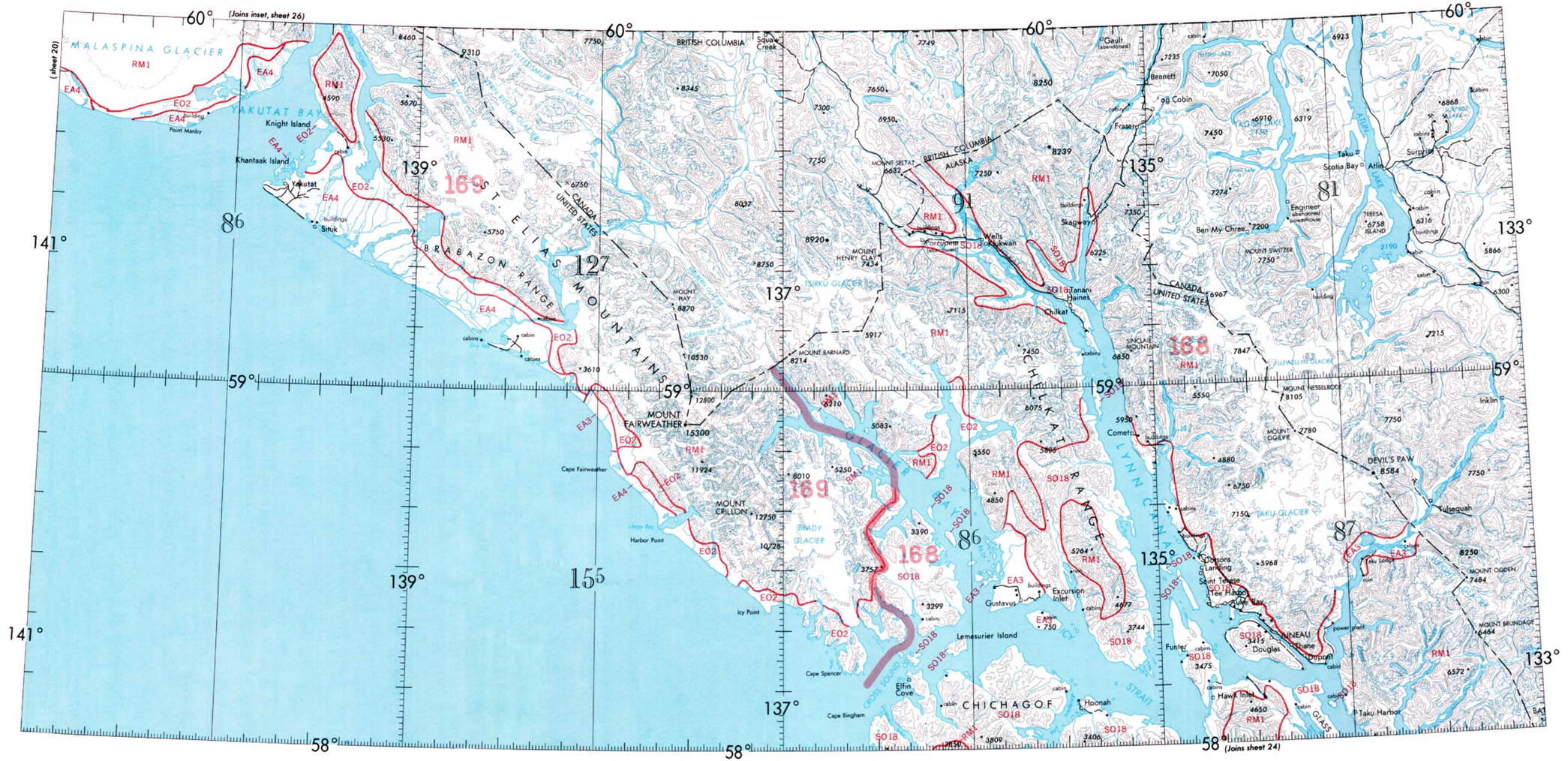
ALASKA EXPLORATORY SOIL SURVEY — SHEET NUMBER 20





22

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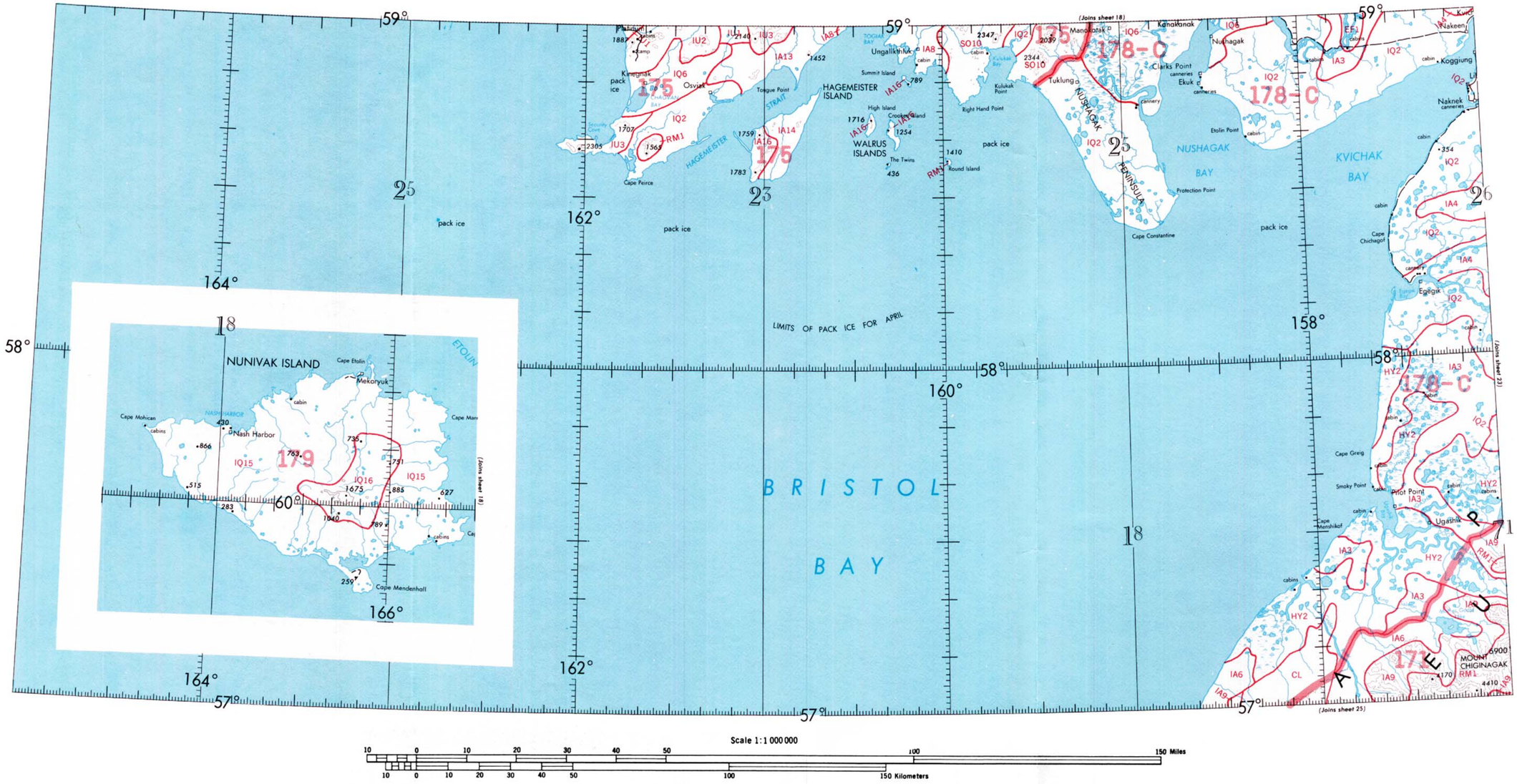
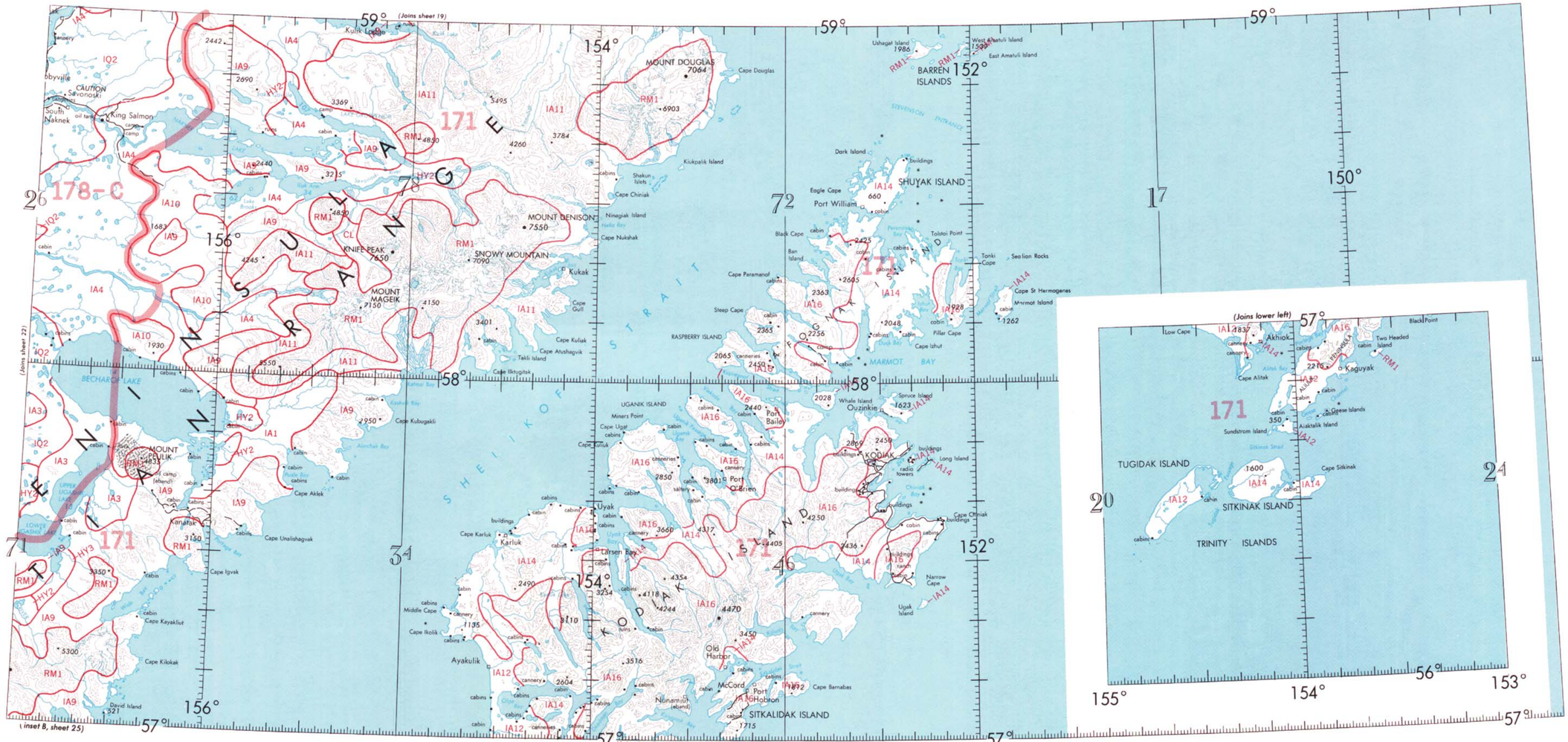


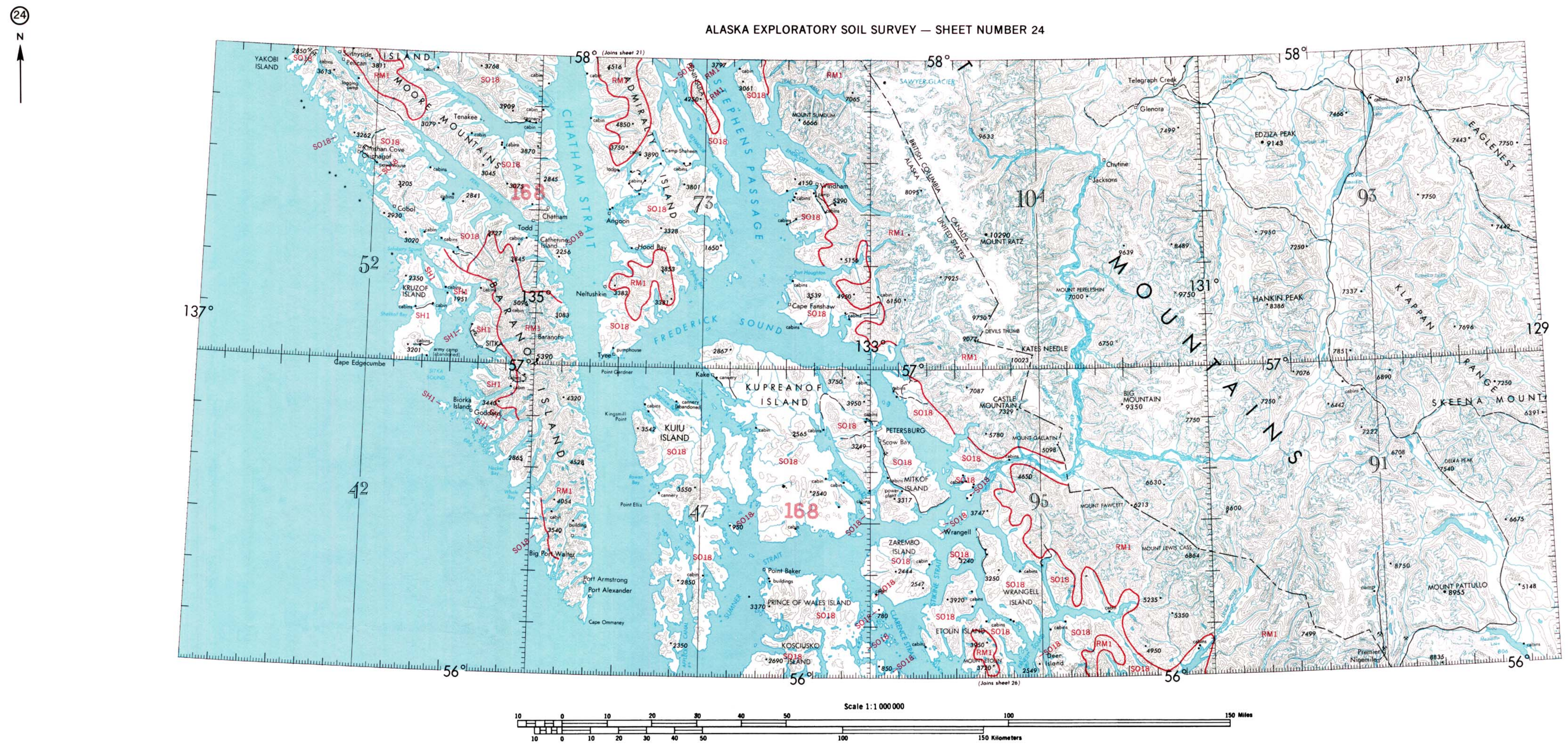
Base compiled 1970 by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey.
Soil Survey compiled 1971 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

ALASKA EXPLORATORY SOIL SURVEY — SHEET NUMBER 23

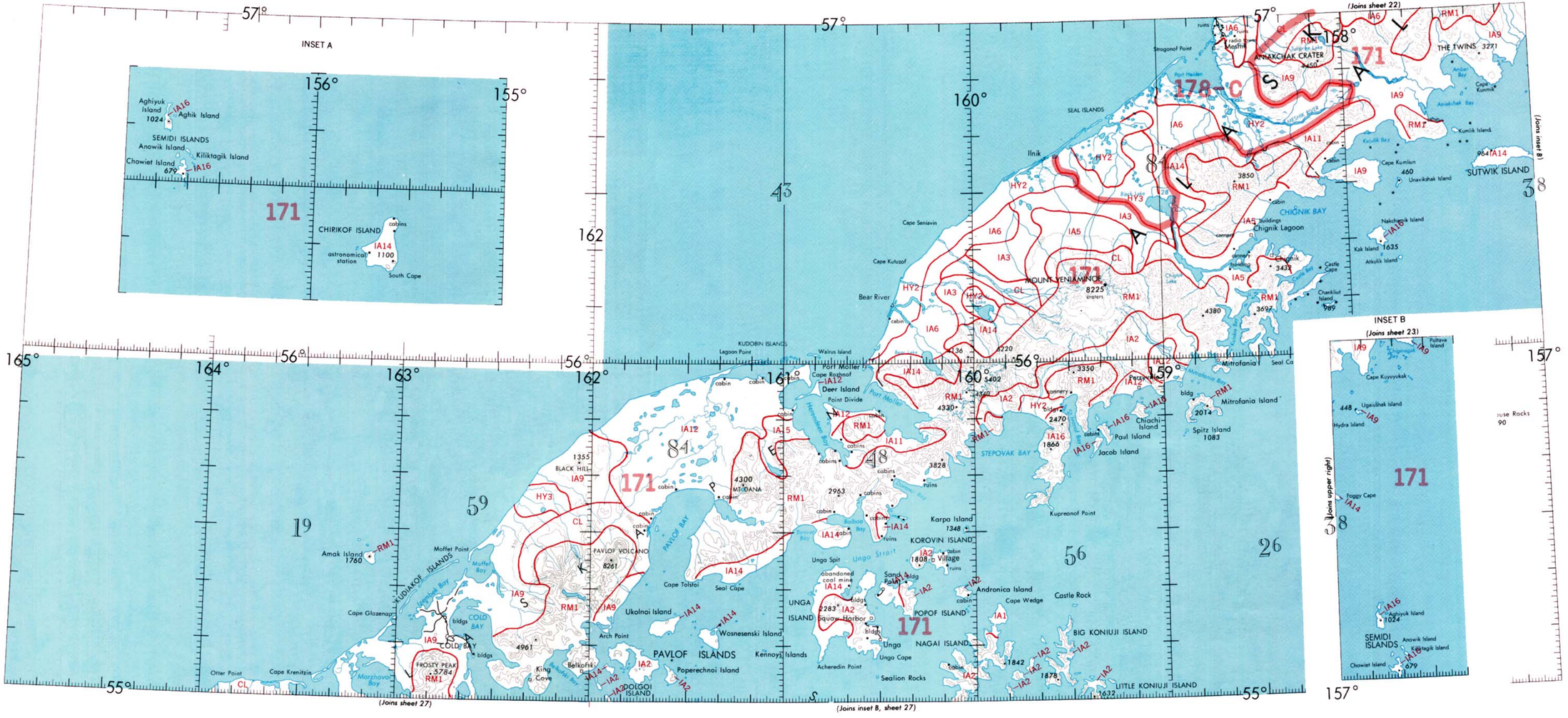


Base compiled 1970 by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, Soil Survey compiled 1977 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

ALASKA EXPLORATORY SOIL SURVEY — SHEET NUMBER 24

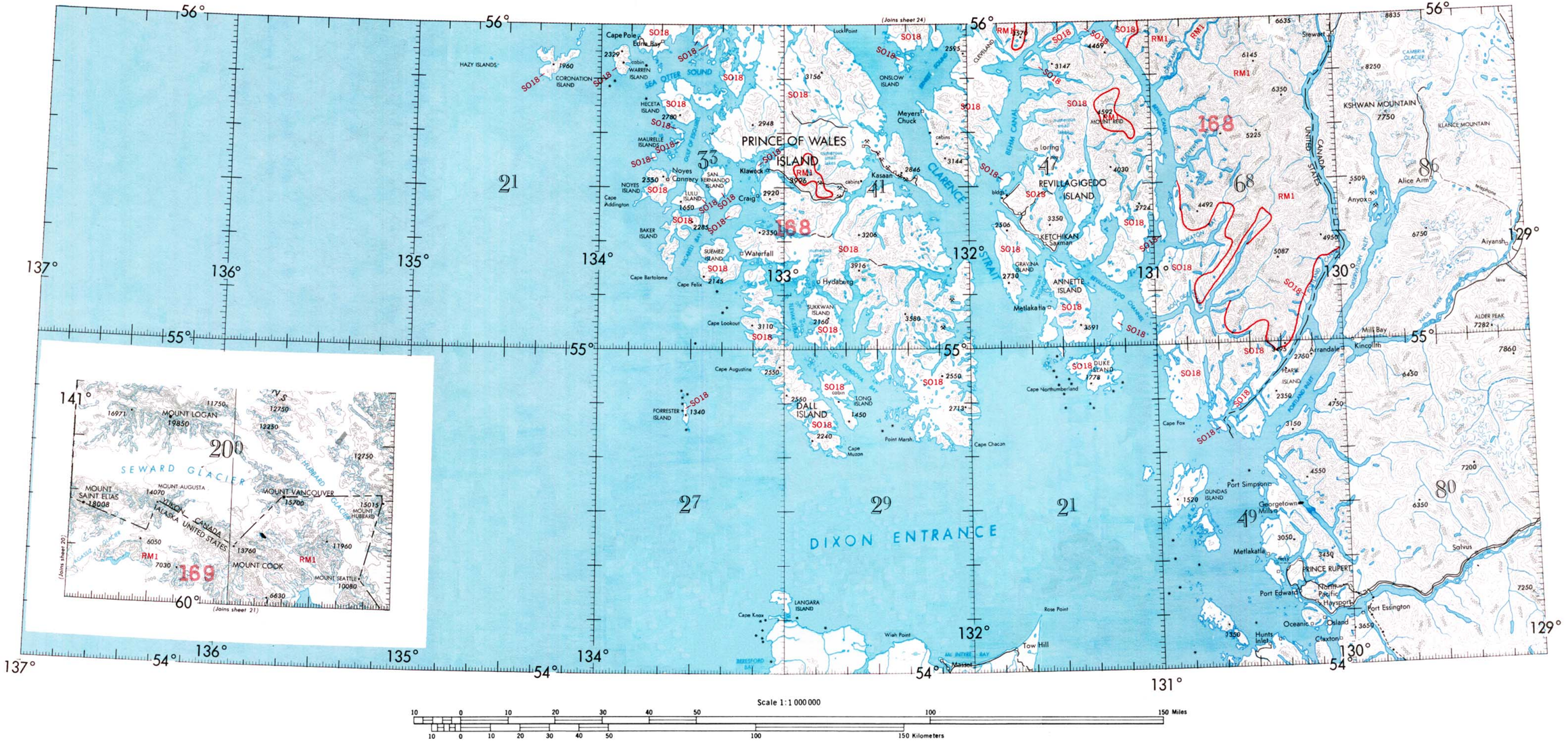


Base compiled 1970 by the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey.
Soil Survey compiled 1971 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.


N
INSET A
INSET B
(Joins sheet 22)
(Joins inset B)
(Joins upper right)
(Joins sheet 27)
(Joins inset B, sheet 27)
Scale 1:1 000 000
150 Miles
150 Kilometers
ANIAKCHAK CRATER
THE TWINS 3271
SUTWIK ISLAND
CHIGNIK BAY
Chignik Lagoon
MOUNT VENIAMINOF
8225
craters
Port Heiden
Stroganof Point
SEAL ISLANDS
Ilnik
Cape Seniavin
Cape Kutuzof
Bear River
KUDOBIN ISLANDS
Lagoon Point
Walrus Island
Port Moller
Cape Roznof
Deer Island
Point Divide
Herendeen Bay
Mitrofania Island
Spitz Island
1083
Chiachi Island
Paul Island
Jacob Island
STEPOVAK BAY
Kupreanof Point
Karpa Island
1348
KOROVIN ISLAND
Unga Spit
Unga Strait
abandoned coal mine
Village
Sanak Island
Andronica Island
Cape Wedge
Castle Rock
POPOF ISLAND
UNGA ISLAND
Squaw Harbor
Unga
NAGAI ISLAND
Unga Cape
Acheredin Point
Sealion Rocks
BIG KONIUJI ISLAND
LITTLE KONIUJI ISLAND
1632
1878
1842
PAVLOF VOLCANO
8261
PAVLOF BAY
Cape Tolstoi
Seal Cape
Ukolnoi Island
Wosnesenski Island
Arch Point
PAVLOF ISLANDS
Poperechnoi Island
Kennoyi Islands
DOLGOI ISLAND
Belkofski
King Cove
Belkofski Bay
FROSTY PEAK
5784
Otter Point
Cape Krenitzin
Marzhovo Bay
KUDIAKOF ISLANDS
Amak Island
1760
Moffet Point
Moffet Bay
Izembek Bay
Cape Glazenap
COLD BAY
bldgs
BLACK HILL
1355
4300
MT. DANA
2953
3828
5402
4340
4320
4220
3350
2470
1866
2014
1808
2283
1348
4961
3784
1100
1024
679
1635
1460
964
3850
3697
3437
4380
3727
3728
3727
Cape Kumlik
Kumlik Island
Cape Kumlun
Unavakshak Island
Nakchamik Island
Kak Island
Atkulik Island
Chanlikut Island
Castle Cape
Aniakchak Bay
Amber Bay
Kuiulik Bay
Foggy Cape
Hydra Island
Ugaushak Island
Cape Kuyuyukak
Poltava Island
Aghiyuk Island
Aghik Island
SEMIDI ISLANDS
Anowik Island
Kiliktagik Island
Chowiet Island
CHIRIKOF ISLAND
astronomical station
South Cape
cabins
bldgs
ruins
Radio Dome
Mastiff
Seltzer Lake
Aniakchak River
Meshik
Ilnik
Port Heiden
Cape Kumlik
Kumlik Island
Cape Kumlun
Unavakshak Island
Nakchamik Island
Kak Island
Atkulik Island
Chanlikut Island
Castle Cape
Chignik
Chignik Lake
Chignik Bay
Aniakchak Bay
Amber Bay
Kuiulik Bay
Foggy Cape
Hydra Island
Ugaushak Island
Cape Kuyuyukak
Poltava Island
Aghiyuk Island
Aghik Island
SEMIDI ISLANDS
Anowik Island
Kiliktagik Island
Chowiet Island
CHIRIKOF ISLAND
astronomical station
South Cape
Mitrofania
Seal Ca
Unga Spit
Unga Strait
Port Moller
Herendeen Bay
Balboa Bay
Izembek Bay
Moffet Bay
Belkofski Bay
Marzhovo Bay
Otter Point
Cape Krenitzin
Cape Glazenap
Moffet Point
Amak Island
Arch Point
Ukolnoi Island
Wosnesenski Island
Seal Cape
Cape Tolstoi
Poperechnoi Island
Kennoyi Islands
Belkofski
King Cove
Acheredin Point
Sealion Rocks
Unga Cape
Andronica Island
Cape Wedge
Castle Rock
Kupreanof Point
Karpa Island
Paul Island
Jacob Island
Chiachi Island
Spitz Island
Mitrofania Island
Deer Island
Point Divide
Cape Roznof
Walrus Island
Lagoon Point
Cape Seniavin
Cape Kutuzof
Bear River
Ilnik
Stroganof Point
Port Heiden
SEAL ISLANDS
Aniakchak River
Seltzer Lake
Meshik
Radio Dome
Mastiff
ruins
cabins
bldgs
cannery
buildings
CL
RM1
IA1
IA2
IA3
IA5
IA6
IA9
IA11
IA12
IA14
IA16
HY2
HY3
171
178-C
43
162
84
48
59
19
56
26
38
98
57°
56°
55°
165°
164°
163°
162°
161°
160°
159°
158°
157°

N

ALASKA EXPLORATORY SOIL SURVEY — SHEET NUMBER 26



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Soil Survey completed 1971 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

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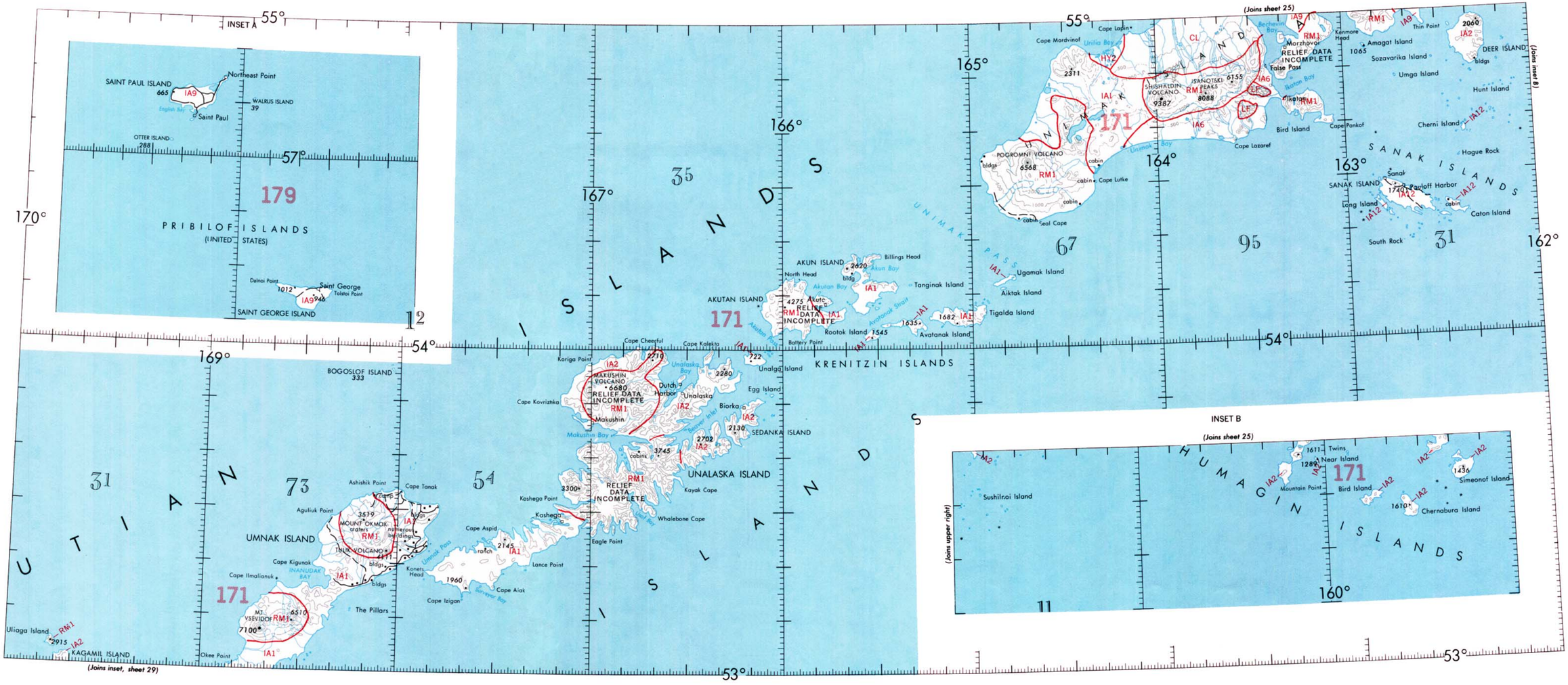

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Soil Survey completed 1981 by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies.

ALASKA EXPLORATORY SOIL SURVEY — SHEET NUMBER 28

N

ALEUTIAN ISLANDS (UNITED STATES)

ISLANDS

04

23

42

39

23

NEAR ISLANDS

33

33

171

RAT ISLANDS

20

40

AMCHITKA ISLAND

42

171

SEMISOPOCHNOI ISLAND

AMCHITKA PASS

20

DELAROF ISLANDS

61

Shemya Island

Ingenstrem Rocks

BULDIR ISLAND

KISKA ISLAND

Little Kiska Island

Tanadak Island

Sea Lion Rock

SEGULA ISLAND

Khvostof Island

Davidof Island

LITTLE SITKIN ISLAND

RAT ISLAND PASS

Krysi Point

RAT ISLAND

Ayugadak Point

OGLAIA PASS

Alaid Island

Nizki Island

SEMICHI

AGATTU ISLAND

Cape Wrangell

Attu

Chirikof Point

Theodore Point

Cape St Stephen

Vega Point

Bukhti Point

Pillar Rock

Sirius Point

Segula Island

Tunan Point

Pochnoi Point

Alaid Island

Nizki Island

Krugloi Point

McDonald Cove

Gillon Point

Cape Sabak

Aleut Point

East Cape

St Makarius Point

TANAGA ISLAND

TANAGA VOLCANO

GARELOI ISLAND

GARELOI

TANAGA PASS

Cape Amagalik

Ogliuga Island

Unalga Island

Kavalga Island

Tlak Island

ULAK ISLAND

AMATIGNAK ISLAND

(Joins river)

(Joins upper left)

(Joins sheet 29)

174°

177°

178°

179°

180°

179°

178°

53°

52°

51°

172°

173°

174°

Scale 1 : 1 000 000

10 0 10 20 30 40 50 100 150 Miles

10 0 10 20 30 40 50 100 150 Kilometers

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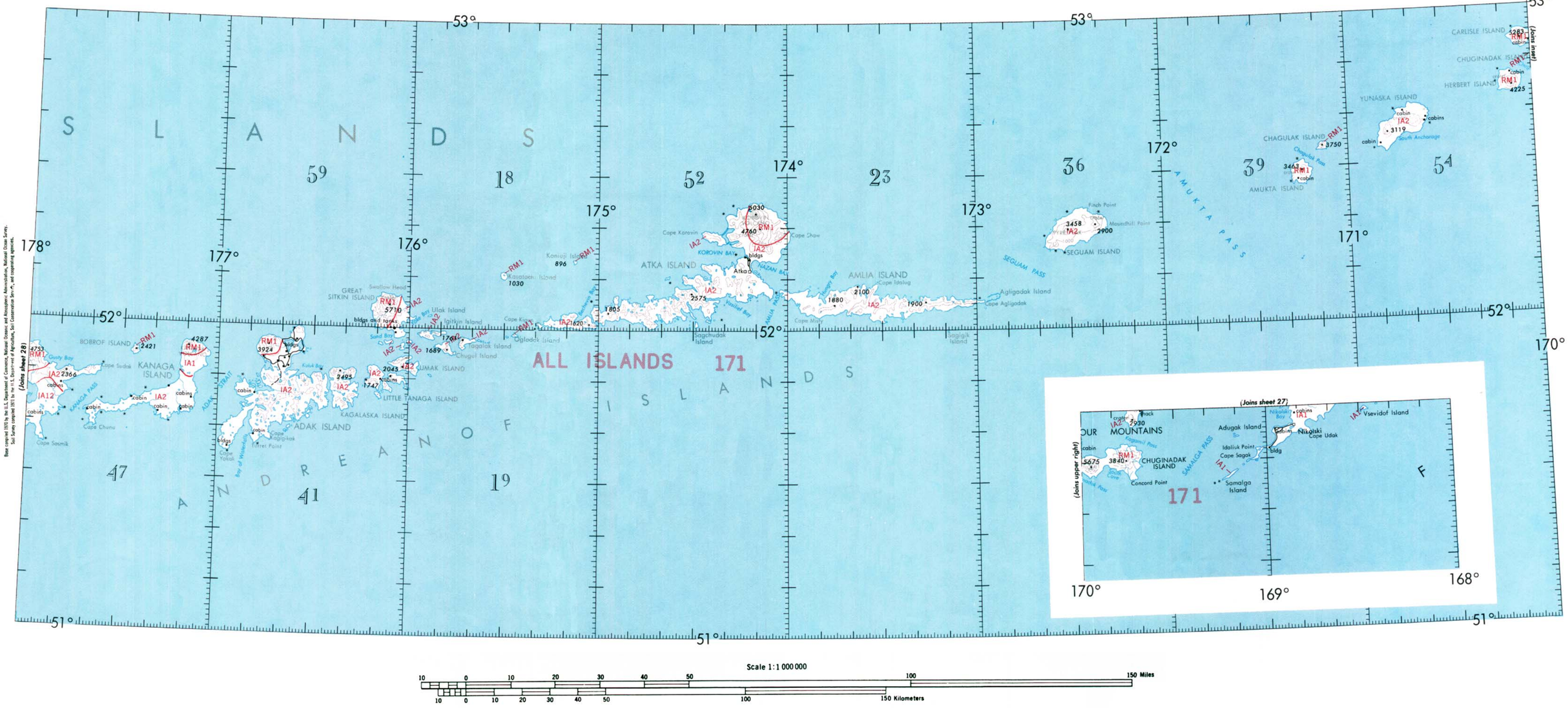
N
ALL ISLANDS 171
ALEUTIAN ISLANDS
ANDREANOF
59
18
52
23
36
39
54
47
41
19
ATKA ISLAND
AMLIA ISLAND
SEGUAM ISLAND
AMUKTA ISLAND
CHAGULAK ISLAND
YUNASKA ISLAND
CARLISLE ISLAND
CHUGINADAK ISLAND
HERBERT ISLAND
KANAGA ISLAND
BOBROF ISLAND
GREAT SITKIN ISLAND
LITTLE TANAGA ISLAND
KAGALASKA ISLAND
ADAK ISLAND
Atka
Nikolski
Cape Udak
Samalga Island
Vsevidof Island
CHUGINADAK ISLAND
OUR MOUNTAINS
Concord Point
Adugak Island
Idaliuk Point
Cape Sagak
(Joins sheet 28)
(Joins sheet 27)
(Joins upper right)
(Joins inset)
Scale 1:1 000 000
150 Miles
150 Kilometers